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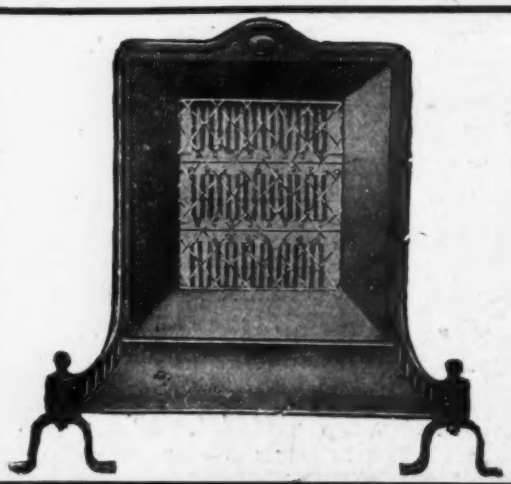

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"ELECTRICAL REVIEW": TIME OF PUBLICATION.

Readers who are receiving their copies of the ELECTRICAL REVIEW a little later than formerly, are reminded that as the result of changes in printing arrangements and in consequence of rapidly increasing circulation, publication recently had to be deferred until Friday afternoon. The REVIEW is now on sale in London at 4 p.m. on Fridays; copies sent by post or obtained through local agents should reach the hands of subscribers on Saturday mornings.

THE ESTABLISHMENT OF INDUSTRIAL COURTS.

THE Industrial Courts Bill has passed the House of Commons, and may soon be the law of the land. While we are inclined to agree with a speaker in the debate on the second reading, that it is a pity a measure of such first-class importance should have been introduced, or should have seemed to have been introduced, as a consequence in some sort of the railway strike, we feel it is best not to be too critical of the reasons for the action of the Government, but to devote some attention to a consideration of the measure itself.

The effect of the Bill, when it becomes an Act of Parliament, will be to establish a Court of Inquiry, and a permanent Industrial Court. The Court of Inquiry will investigate disputes, and report to the Government, and the report will be laid before Parliament. The Industrial Court is to hear both sides in a dispute, and to pronounce upon the points at issue. So far so good, but there is to be no compulsion upon either party to observe the verdict or to carry out its provisions. It was fairly conclusively shown in the debate that it is in truth an impossibility to compel masses of workpeople to carry out a line of action with which they are not in agreement, or which they believe to be unjust. Clearly compulsion cannot be applied in a one-sided manner, and this point was fully admitted by the speakers of the Labour Party. Therefore there is no compulsion either way, and many think that complete freedom of action will, in the long run, be productive of more good than any attempt at despotism, even on the part of qualified and approved arbitrators. Besides, there is another point, though, to our surprise, it was not mentioned at all in the House, and that is this: that only the edicts of Parliament itself or of the judicial Courts whose duty it is to interpret them can possibly be allowed to have the full force of law. To strengthen the Whitley Councils, and give their decisions legal force, or to vest the Industrial Court with compulsory powers, would lead to a state of confusion which would call for endless legislation, and would lead to actions galore in the Civil Courts, for the purpose of attempting to clarify it.

The Court of Inquiry is to have certain very definite powers, quite proper to its important functions. Among these we may note the summoning of witnesses, the taking of evidence upon oath, and the imposition of penalties for perjury. Clearly, if the work of the Court is to be of any permanent value at all, such powers are entirely necessary. The Court is also given power to call for the production of books and documents, but will only be entitled to make public the information which is relevant to a dispute. As Mr. Clynes remarked, there is very little on the labour side that the Trade Unions do not make public, but the documents relating to contracts, profits, prices, and wages, and especially those having relation to the numerous agreements for price maintenance and the like, are generally kept very much in the background. They might be very relevant to a wages dispute, and some interesting facts might thereby be brought to light.

The primary cause of industrial disputes is the question of pecuniary reward. Conditions of employment, character of supervision, sympathy with workers on strike elsewhere—

these are all fruitful secondary causes, but ample monetary satisfaction compensates for a multitude of smaller annoyances. We are convinced that a properly arranged system of payment by results, approved by both sides, would have more effect as a preventive of stoppages due to industrial disputes, than any other thing it is humanly possible to accomplish. With that system set up through the medium of the Whitley Councils in the various trades and industries, the Courts described in the Bill we are now discussing are seen to be a necessary corollary, providing, as they do, independent tribunals for investigating all the facts, and for pronouncing judgment upon them. It is found universally that where such a system exists—as in the works of Messrs. Priestman Bros., Ltd., or of the Gloucester employer (unnamed) referred to by Mr. Clem Edwards—there is an all-round improvement. It is very seldom that the question is encountered that has recently been asked by Mr. G. H. D. Cole :—"Why should the man who produces more be paid more than the man who produces less?" The plain answer to such a question is that the reward for service rendered is the power to avail oneself of the services of others, and that as the power to command service is represented by money, the man who renders greater service is entitled to enlarge his life by availing himself more of the services of others—in short, to receive more money and to spend it as seems good to him. If this principle is denied, the logical outcome is the present chaotic system of society, whereby the drones get the honey while the workers provide it. For we may rest assured that no system of equal division would remain stable for a single day.

We welcome the Bill, then, as a step in the right direction. It seems to us to foreshadow the restriction of interference by the State to the province to which that interference properly belongs—the throwing of much-needed daylight into the dark places of industry, the blowing of a healthy breeze of public opinion through the cobwebs surrounding it, and a fostering of the spirit of co-operation which is generally recognised as the prime and greatest need of the industrial situation as it exists at the present time.

The Liquid Assets of the A.E.G.

It used to be with sentiments of intense satisfaction and glorification that the directors of the A.E.G., in their annual reports, or at the general meetings, pointed out in pre-war days the enormous sums which they had standing to the credit of the company at their bankers, amounting to several millions sterling at the rate of conversion which prevailed in the former period of peace. Now, however, the liquid funds have become so contracted that it is proposed to equalise matters by the issue of a loan for 100,000,000 marks (pre-war £5,000,000). It is true that wages and salaries in 1918-19, as the company's financial statement sets forth, experienced the very considerable increase of 120,000,000 marks (£6,000,000), which sum under normal conditions would naturally be charged to the account of working expenses before the balance for the year was struck. If this practice has not been followed in the past financial year, it is little wonder that the company proposes to pay, as was mentioned a week ago, a dividend at the rate of 10 per cent., as contrasted with 14 per cent. in 1917-18. Yet on June 30th, 1918, the company's credit at the bankers was reported to have increased to 152,700,000 marks (pre-war £7,635,000), as a result of the sale of the company's interests in the Elektro-Werke of Bitterfeld. It is not stated, at least, down to the present time, how this credit stood on June 30th, 1919; but as a loan for £5,000,000 is now considered necessary owing to the shrinkage of the liquid assets, it looks as if questions other than those relating to the dearness of raw materials play a part in the necessity for the raising of additional loan capital to compensate for the reduction in the liquid funds. The loan capital already amounts to over 110,000,000 marks (£5,500,000), and the ordinary share capital to 200,000,000 marks (£10,000,000). It is possible that some light will be thrown on the situation when the annual report is published.

German South American Interests.

An extraordinary upward movement has taken place in Germany in the ordinary shares of the Deutsche Ueberseeische Elektrizitäts Gesellschaft (German Trans-Marine Electricity Co.), which is the greatest oversea undertaking in that country, and which owns large supply works at Buenos Ayres and works at Monte Video, Uruguay, together with interests in Chile. During the course of the war the quotations for these shares declined with the depreciation of the mark; the price was 150 per cent. in the middle of 1914, 150 per cent. at the end of 1916, 135·50 per cent. in 1917, and 133 per cent. at the close of 1918. To-day, 11 months since the last-mentioned quotation was made, the price exceeds 500 per cent. It is assumed that the rise is due to speculative reflections based upon exchange considerations. In fact, the lower the level of the mark the higher the speculative value of the shares. The company's undertaking has been built up by issues of securities between 1900 and 1914, amounting to about £12,500,000, which sum was invested on a gold basis of the mark in the works and subsidiary companies in South America, whilst the reserve funds, which were also formed in peace times, raise the total investments in Argentina, Chile, and Uruguay to £15,000,000 on a gold basis. As a consequence, the total would produce a yield several times greater than the paper mark value at which the investments stand in the company's books to-day, owing to the depreciation of the mark. If then some, or all, of the properties in South America were sold or mortgaged, the considerable additional value could be capitalised.

On the other hand, in the case of funds coming to hand, the company is authorised—only since 1918—to redeem in paper marks plus 3 per cent. premium, the seven existing loans which totalled £5,267,000 in 1916. If this operation were carried into effect, a large portion of the premium on the South American investments would devolve upon the ordinary shares. Besides the ordinary shares of £6,000,000, there are preference shares of £1,500,000, and if the company were to decide upon liquidation, the preference shares would be repaid with a premium of 10 per cent., whilst the ordinary shareholders would receive the remainder of the assets. In these circumstances it is scarcely surprising that speculators both in Germany and Switzerland have caused the ordinary shares to rise to over 500 per cent. The calculation, however, stands or falls with the fall or rise of the mark on the one hand, and with the liquidation or continued existence of the company in its present form on the other.

Metropolitan Traffic.

On Nov. 25th a lecture was delivered by Mr. H. H. Gordon, A.M.Inst.C.E., before the Institution of Civil Engineers, on "Some Aspects of Metropolitan Road and Rail Transit," which is worthy of the careful perusal of everyone who is interested in this subject. Mr. Gordon, who has made a study of the problem for many years, deals with it on scientific lines, analysing the conditions which govern it and judicially examining the means by which it can be solved. His conclusions fully bear out our comments in a recent leading article on the subject of passenger transport in the Metropolitan area.

One of the most striking points that he brings out is the enormous and never-ceasing growth of traffic on the London streets; in the decade ending in 1913 underground traffic increased by 170,000,000 passengers, and surface traffic by no less than 870,000,000! "Even where motor traffic largely predominates there has been no real decrease in road congestion, and in the central area of London it is found uneconomical to employ motor delivery vans. The carrying capacity of the highway has been, and remains, taxed to the uttermost." We may point out that in the central area of London there are no tramways;

hence the tramcar is guiltless of producing congestion in this region. There are numerous underground railways serving this area, but, as the author shows, no relief to surface traffic is gained by adding tubes—before the Central London Railway was opened, 390 horse omnibuses passed along Oxford Street per hour, whilst in 1913, at times when the Central London Railway was packed to repletion, 517 motor-omnibuses, with 70 per cent. greater accommodation than in 1895, were unable to cope with the demand made upon them. The same phenomenon has been observed abroad. "Surface traction always grows more rapidly than any underground system," and "congestion on the highway will continue to be a problem unless the solution to it be found on the surface of the streets."

Mr. Gordon points out that the laxity of control over the traffic, by permitting many flagrant abuses, results in the inefficient utilisation of the carrying capacity of the highway; on London Bridge, for example, where there are no standing vehicles to obstruct the way and no crossings, even at the hour of maximum intensity of traffic the efficiency observed was only 41 per cent. Much could be done to ease the congestion if vehicle drivers could be induced to "keep in line."

The author discusses the question of street crossings, and shows that they should be rectangular; but he has no radical remedy for the delay due to the necessity of traffic regulation, except the drastic one of viaducts or subways, and we cannot say that his modification of the "gyratory system" ("Booth's circus") offers much hope of adoption. "In 1902 all traffic was animal driven; in 1914, 83 per cent. was power driven," and it is to the power of rapid acceleration and deceleration that he attributes the saving of the situation, aggravated by the doubling of the traffic in the interim.

As to the "flexibility" of motor traction, which enables traffic to deviate from congested routes, the author discusses its merits in detail, and dismisses it with the faintest praise. As he points out, when the road is free from congestion, flexibility is not required; when the road is congested, flexibility cannot be availed of, for the motor vehicles cannot manœuvre. He disagrees, for stated reasons, with the estimate of the Traffic Branch of the Board of Trade as to the relative obstructiveness of the tramcar and the motor-'bus, and makes the sound point that obstructiveness should be assessed on the basis of the number of passengers carried, and not that of the number of vehicles in use; on the former basis, even taking the Traffic Branch's estimate of obstructiveness, the motor-omnibus is seen to be, in the aggregate, the most obstructive passenger-carrying vehicle on the road.* Moreover, as a lethal instrument the omnibus is easily first—partly as a result of that flexibility which enables it to appear at unexpected places. In 1918 the Metropolitan police stated that the fatal accidents numbered 2·8 per 100 tramcars and 6·75 per 100 omnibuses; on the passenger basis, the relative figures would become 2·8 for the tramcar and 15·5 for the omnibus. The very fact that omnibuses leave the fast-traffic line to load or unload at the kerb, for which much is claimed by their advocates, materially adds to their obstructiveness, as was pointed out by the Advisory Board of Engineers of the Royal Commission on London Traffic.

Considerations of space prevent us from dealing with the second part of Mr. Gordon's paper for the moment, and we conclude by once more expressing regret that, by withholding its papers from publication, the Institution of Civil Engineers continues to suppress—so far as the general public is concerned—much valuable information.

Christmas Presents.

The Society for Electrical Development, U.S.A., has for some months been carrying on a campaign for "An Electrical Christmas"; through this "drive" the public is learning of the appropriateness of electrical devices as Christmas gifts, and reports from members and others indicate that the move is producing excellent results. We wonder whether our readers have grasped the possibilities that lie open to them in this direction. Those contractors and supply undertakings who have showrooms are in an exceptionally good position to take advantage of the season, and ought to be able to do good business if they make a point of putting forward appropriate articles such as kettles, toasters, radiators, table and floor standards, bed-warmers, &c., and emphasising their suitability for Christmas presents. It is well worth their while to take special steps to draw the attention of the purchasing public to the matter; choosing presents is an arduous and nerve-racking performance, and the salesman should do his best to make the choice for his customers, who should be shown the novelty and the common-sense of the electrical gift. To aid in this campaign, the prices of the goods should be plainly marked, and some particulars of the cost of using them should be furnished.

The Old Gang.

There is an "Old Gang" in electrical as well as in political circles. This term of political slang signifies, so far as we conceive it, a caucus of individuals who hang on to an antediluvian policy, and have no scruple in stemming or diverting the tide of progress, if by doing so they can maintain their own petty, personal eminence. Now it will not be long before we shall begin to be aware of an "Old Gang" in electricity supply circles. The Electricity Supply Bill, when it comes into operation, will be as active as a litmus paper in detecting their "acid" reaction! Chiefly, we surmise, the "Old Gang" spirit will manifest itself in London. Directly the Commissioners intimate that the supply in London calls for reoganisation, and look as if they really meant business, straightaway will the "Old Gang" make themselves felt. If they are outside they will become the organised obstructionists. If they are inside, that is, if they become parties to some electrical scheme of reorganisation or centralisation, they will be felt as the dead weight. It has been the perennial cry of the electricity supply industry that the whole business has been handicapped through Parliament having in the Electric Lighting Acts adopted the "parochial" area in the prescribing of districts for supply. But the industry has suffered equally by a "parochialism" imposed, not by Parliament on these areas, but by Nature on many of those who were responsible for conducting the industry. Times out of number, this parochial spirit has cropped up, this spirit of suspicion of innovation, of opposition to any alteration of existing conditions, of fighting exclusively for one's own hand, of jealousy of one's neighbour. It was worst, of course, in the early years. Gradually the influence of the Parliamentary conflicts seems to have stimulated quite the opposite spirit in some, at least, of the London undertakers. But these left behind them still an unbroken "Old Gang," who steadily opposed any reform. The 1908 Act was obtained, after much strenuous work, but, witness the power of the "Old Gang," it has been practically a dead letter, so far as co-operation or centralisation of supply is concerned. And when the present Bill came along effort was not lacking in the direction of an attempt so to circumscribe the operation of the Bill as to render it actually inoperative. It needs no great prescience to forsee, therefore, that the "Old Gang" tactics will recur, even if in a modified degree, in the near future directly anybody proposes actually to *do* something. We have mentioned London specially, but there are quite worthy representatives of the "Old Gang" in a good many other parts of the country. Still, if the Commissioners are energetic enough, we may yet live to see the "Old Gang" join the Dodo.

* The official "factors of obstruction" are for the tramcar 9, and for the omnibus 4; as 230 'buses would be required to replace 100 tramcars (in fine weather—far more in wet weather)—the aggregate obstructiveness of the omnibus is 2·3 × 4 = 9·2.

THREE-PHASE METER TESTING.

By A. J. BRIDGE.

The electricity meter dealing with the measurement of power on large three-phase undertakings is a very important piece of apparatus; it forms the connecting link between the cost of production of electric power and the consumer, its indications being the basis on which the revenue of a power supply undertaking is ascertained. The accuracy of the meter entrusted with this important function is a matter of vital importance affecting not only the profits of the undertaking, but the goodwill of the consumer, who rightly expects an adequate return for his monthly power bill. The testing, therefore, of these meters is a matter which should be given very careful attention.

The apparatus used for three-phase meter testing varies largely with local conditions; the opinions of engineers vary somewhat on this subject. Necessary apparatus will include a potential transformer with secondary windings capable of giving the standard meter voltage used, usually 110 volts, and current transformers having a wide range of ratios to enable meters of any ratio to be dealt with. The potential transformer will be used in conjunction with the standard voltmeter and wattmeter, the current transformer in conjunction with the standard ammeter and wattmeter. Instruments will include voltmeters, ammeters, wattmeters and a stop-watch. The former instruments should be tested in conjunction with the current and potential transformers by some recognised authority. The cables which will be used in connecting up in the test-room should be included in this test. The tests should be made at various loads and power factors, the errors observed being plotted for reference and application when the testing set is installed in the test-room as a standard.

The forms of supply for testing purposes are various; installations of potential and series transformers making a single-phase supply available for testing are largely met with, also motor-driven A.C. generators. The latter are by far the best, as three-phase currents of any magnitude and voltage are available. The usual method adopted is to mount two A.C. generators—one generating current and the other pressure—on a common shaft with a motor; power factor adjustment is obtained by making the outer yokes movable relatively to each other. Suitable tappings can be arranged for giving various voltages and series-parallel connections for various currents.

Meters used in conjunction with current and potential transformers must always be tested together. It is a matter of the greatest importance that the actual conditions under which the meters will be working when measuring the power consumption of a consumer be established in the test room. In a large number of cases meters have shown excellent tests of accuracy in the test room, but have given very baffling results when erected on the consumer's premises. These errors can usually be traced to some new element introduced in the working of the meter after it has left the test room. Frequently overload trip-coils are operated from the same current transformer as the meter, and time-lag and other apparatus in the secondary of the potential transformer. To obtain an accurate test all these auxiliaries should be included in the test-room circuit. The effect of this additional apparatus in the secondary circuit of the transformer not only influences the transformation ratio, but also the phase relationship between primary and secondary. Theoretically, the ratio of transformation is the number of turns of primary to secondary, and the secondary current should be in exact opposition to the primary. Actually neither of these conditions exists, because of the current required to excite the core and overcome the copper losses. It will be clearly seen, therefore, that to obtain reliable test figures the service conditions of running must be maintained in the test room. From the foregoing remarks it is obvious that the ideal arrangement is to provide transformers exclusively for operating the watt-meters. In testing, any errors in the transformers of ratio or phase displacement can be corrected in the meters.

Care should be taken in making the necessary connections to avoid the possibility of stray fields affecting the meters or transformers. The heavy current-carrying cables should be kept as far as possible from the meters, loops round or near current transformers should be carefully avoided. It is also necessary when connecting up polyphase meters to connect the "lagging" phase of the meter to the "lagging" phase of supply. It has been found that when a polyphase meter is calibrated with one element in the lagging phase, and the other in the leading phase, and then the phases are interchanged the readings will not correspond. This is due to the fact that with a load of unity power-factor, the current in the lagging phase is 30° behind the pressure, and that in the leading phase 30° ahead. It is, therefore, necessary that in connecting up the meter for testing the same element should be connected to the lagging phase as is intended to be connected to it when installed on consumers' premises. This matter was taken up some time ago with the National Physical Laboratory, and the following agreement arranged:—"The terminals of the lagging phase are to be marked red, and the terminals of the leading phase to be marked blue." Makers who do not adopt this practice mark the elements "lagging" and "leading." It will be seen that this system of marking must also be applied to the current and potential transformers, and it is usually adopted.

Assuming that the meters are connected up ready for testing, if they have not previously been on circuit, they should be run for a period of time previous to the test to enable the temperature of the potential coils to become constant. This run should be of about one hour's duration. The average power-factor of the circuit on which the meters are intended to operate should be ascertained, and tests carried out at that power-factor at one-twentieth, one-tenth, one-half, and full load. In addition, tests at 0·5 lagging power-factor should be made to enable the accuracy of the meter when operating at low power-factor to be ascertained. This is a condition met with on large industrial loads usually when the load is light during meal hours and week-ends. These tests, therefore, need only be taken at one-twentieth and one-tenth loads.

The usual method of testing induction-type meters is to time the meter disk for a specified number of revolutions with a definite load in watts passing. The number of watts indicated by the meter can then be calculated after ascertaining the relation in speed of the spindle to the unit dial. This is the basis on which this type of meter is tested, but the method has been somewhat modified by the leading meter manufacturers, who have generally adopted a speed of 40 R.P.M. for the brake disk on full load. The disk revolutions should be taken for a period of at least one minute, the time being carefully checked by a stop-watch. The average watts passing during the period of test should be carefully noted, and the accuracy of the meter calculated by the following formula:—W = standard indicated watts; W_1 = calculated meter watts; R = number of revolutions taken; T = time in seconds for R revolutions; K = constant depending on the capacity of the meter; C = speed constant or revolutions of disk per unit as marked on the meter name-plate.

Then $K = 3{,}600 \times 1{,}000/C$.

Hence $W_1 = K \times R/T = (3{,}600 \times 1{,}000 \times R)/(C \times T)$,

and the error is $= (W - W_1)/W \times 100\ \%$ slow, or $(W_1 - W)/W \times 100\ \%$ fast,

according as W_1 is greater or less than W.

Another method, which is probably more convenient, is to determine the actual number of disk revolutions per KW.-hour at any given load, and to compare this with the speed constant C, as marked on the meter name-plate.

Let c = calculated revs. per KW.-hour,

then $c = (3{,}600\ c\ 1{,}000 \times R)/(T \times W)$,

and the error $= (c - C)/C \times 100\ \%$ fast, or

$C - c/C \times 100\ \%$ slow, as c is greater or lesser than C.

In making these tests it is necessary to employ two observers, one to take the revolutions of the brake disk by stop-watch, and the other to take the average wattmeter indications. Both these operations require great care; care should be taken that the stop-watch is started and stopped at the exact moment the mark on the disk passes the mark on the meter-case. In reading the standard wattmeters the *average* watts must be recorded; however steady the reading may be, some slight variation is almost bound to be noticed. The time period of these variations must be taken into consideration when arriving at the average watts for the test period. Errors due to parallex must also be carefully avoided. Should it be required to test a polyphase meter on a single-phase current, it must be remembered that the meter, under these conditions, is of twice the rated capacity, *i.e.*, assume a three-phase current of 40 amperes, 400 volts between phases; the power in the circuit would then be $40 \times 400 \times \sqrt{3}/1{,}000 = 27{\cdot}7$ KW. Whereas the capacity of the corresponding single-phase meter would be $40 \times 400 \times 2/1{,}000 = 32$ KW.

When testing in this manner, the value "C" stamped on the nameplate becomes exactly the same as for single-phase meters of the same current and voltage; in other words, the speed constant will be double that marked on the nameplate. In these tests it is necessary that both the shunt coils be connected during testing, the current coils being in series. Calibration of motor-type meters is quickly and easily effected, provision being made for adjusting for full load, light load, and power-factor. Full-load adjustment is effected by moving the permanent magnet towards the periphery of the disk which decreases its speed, or *vice versâ*. Light-load adjustment is effected by moving the positions of brass loops located in the leakage air gaps of the shunt laminations. Compensation for power-factor is affected by the movement of another brass loop arranged to move up or down the pole tip of the shunt magnet.

As clock-type meters are used considerably in the measurement of power on large installations, a few remarks on their testing may be useful. The test periods are much longer than for motor-type meters, as the unit indication of the dials has to be taken and checked against the indications of the standard wattmeters.

The tests should be made as long as possible, the reading taken on the meter being never less than one revolution of the last dial fitted with a pointer. The test period must be for a period of time which is a multiple of 20 minutes; this is essential to obtain a test period having an equal number of reversals of the commutator, and eliminates any slight error due to lack of synchronism in the pendulums. This error would not be noticeable on the unit dial, but might possibly affect the one-tenth or one-hundredth unit dials.

Before testing, the meter should be run on its shunt circuit for at least 10 minutes, the reason being that the gear actuating the reversing lever requires this amount of time to settle into position after the meter has been carried about. The shunt current should always be applied before the main current, the first readings of the dials being taken just before closing the main switch. At the conclusion of the test the main circuit should only be opened and the dial reading taken. The accuracy of the test depends on the reliability of the chronograph as much as on the reliability of the standard wattmeter. The meter may also be tested for dial "creep" by connecting the shunt circuit only and allowing the motor to run for several hours, careful note of the dial readings being kept.

Calibration of the meter can be effected by moving the main coils up or down, or increasing or decreasing the resistance of the coils in series with the pendulums. The latter is the usual and most reliable method. The resistance of the pendulums and coils is marked on each meter, the wire used for winding these having a resistance of 60 ohms per yard. Calibration percentage can be determined by calculating the length required to be added to reduce a positive error or the length required to be taken off to correct a negative error. For example:—

Meter = 5 per cent. fast.
Resistance of coils = 57,000 ohms.
" " pendulums = 1,500 ohms each.
Total resistance = 57,000 + 3,000 = 60,000 ohms.
Total length = 60,000/60 = 1,000 yards.
5 % of 1,000 yards = 50 yards to be added to coils.

It is frequently necessary to test meters on site. In such cases a portable standard testing set should be provided, consisting of similar apparatus to that used in the test-room. The current transformers should be of the "thread on" type, the ratio of transformation can thus be varied to meet with any ratio requirements. A common practice for testing meters *in situ* is to introduce a standard induction type watt-hour meter in the meter circuit. Such an arrangement alters the ratio of transformation of both potential and current transformers, and in the case of the latter, the phase displacement. The figures obtained from such tests are useless in arriving at a correct check on the consumer's meter. The test meter places additional load on the transformers, causing inaccuracies in readings between standard and consumer's meter, and gives an inaccurate measurement of the primary power.

COMMERCIAL COAL TESTING.

By J. DEVLIN.

The subject of coal testing has received much publicity of late, but it is hoped that the following notes on routine testing, as performed by a disabled soldier, may prove of interest and value.

The writer is occupied in general testing work in the laboratory of a large electricity supply undertaking, and is responsible for all the coal testing. The description of the coal-testing operations is accordingly taken directly from practice.

The coal to be tested comes to the laboratory in sealed tins containing about 12 kilogrammes of fuel. It is then quartered, and a representative sample weighing about 15 grammes is taken for the moisture test, while a further sample of 5 grammes is ground to powder preparatory to testing for calorific value.

The order in which the tests are carried out is—(1) moisture test; (2) calorific value test; (3) determination of volatile matter, ash, and carbon contents.

Moisture Test.

The moisture test is done by weighing 10 grammes of coal (as received) into a counterpoised tray. It is then placed in an oven, the temperature of which should be 102° C., and left to dry for 4 hours. (This time has been established as standard from experiments.) It is then re-weighed.

The loss of weight multiplied by 10 = per cent. moisture.

Calorific Value Test.

The outfit used is the standard "Sarco" high-pressure bomb calorimeter and auxiliary gear, slightly modified to give greater ease in manipulation. The complete processes of a coal test is given below, together with the approximate times required to carry out each operation.

It may be mentioned that this work has also been done with entire success by a one-handed ex-soldier.

For this test it is necessary that the coal should be powdered.

Put several grammes (say 5) in a tray, and place in oven to dry for 1 hour. The temperature should be as above (102° C.).

Weigh 1 gramme into a counterpoised crucible, and transfer to a bomb.

Admit oxygen to not less than 350 lb. per sq. in.

Transfer bomb to calorimeter, the water in which should be 1° C. less in temperature than that of jacket. Stir till temperature is constant (usually about 2 minutes) observe thermometer. Ignite coal and observe the maximum temperature (attained after 5 or 6 minutes' burning).

The difference between temperature 2 and temperature 1 enables us to determine the calorific value of coal. By consulting table of calorific values (for that particular bomb used), we get the B.TH. units. This value is for "dry coal." We then take the per cent. moisture off, which gives the value "as fired."

Ash Test (on Coal Sample).

Weigh 2 grammes of dry powdered coal into a counterpoised quartz crucible. Put lid on and place on a Bunsen burner until one minute after flame disappears from edge of lid (about 5 minutes). Re-weigh. Loss of weight multiplied by 50 = per cent. volatile.

Keep the lid off and replace crucible on Bunsen burner until weight is at a minimum (about 1½ hours). Re-weigh, then loss of weight multiplied by 50 = per cent. carbon.

Final residue multiplied by 50 = per cent. ash.

Ash Tests.

The ash is powdered and dried in the same manner as the coal for the calorific value test.

Calorific Value Test.

Weigh half a gramme of ash in a counterpoised crucible. Add 1 gramme of dry powdered coal, the calorific value of which is known. Transfer to bomb and proceed as in coal testing (calorific value).

On getting the temperature rise, and consulting the table of calorific values, subtract the calorific value in British Thermal Units of the sample of coal used, and multiply the remainder by 2.

This gives us the British Thermal Units for "ash."

Ash Test (Percentage).

Weigh 2 grammes powdered ash in a counterpoised crucible. Place on Bunsen flame for 1½ hours. Re-weigh. Residue multiplied by 50 = per cent. ash.

The following are a few of the points observed when making tests:—

1. It is not satisfactory to use the sample, which has been dried for the moisture test, to determine the calorific value of the fuel. If this is done the calorific value will generally be found to be low owing to some of the volatile matter having been driven off along with the moisture.
2. The practice of burning ash samples along with a small quantity of standardised coal has been introduced because it was found almost impossible to get complete combustion of the ash unless this was done.
3. Where the gas supply is variable great care must be taken to ensure complete combustion in determining the ash content, as with an ordinary Bunsen burner, the time required with poor gas may be much longer than the 1½ hours specified above.
4. The calorimeter and accessories may be rapidly and easily checked for accuracy by determining the temperature rise in a given time due to an electrical heating element of suitable capacity.

In conclusion, a list of apparatus actually used and a typical set of results obtained from a sample of Lanarkshire coal are given.

List of Apparatus.

1. Chemical balance capable of detecting a difference of ·0001 gramme with 100 grammes on each pan. Complete with weights from ·005 to 50 grammes.
2. One Sarco bomb calorimeter.
3. One thermometer, range from 10 to 25° C., divided down to ·02°.
4. One dessicating oven.
5. One 40-cb. ft. oxygen cylinder, fitted with pressure gauge.
6. One high-temperature Bunsen burner.
7. Six fused-silica crucibles.
8. Six bomb crucibles.
9. One pair crucible tongs.
10. One pair tweezers.
11. One battery, about 8 volts, for ignition.

Example.—Sample of Coal.

Moisture Test.

Weight before drying	... ...	= 10 grammes.
Loss of weight after drying	...	= ·92 gramme.
∴ Moisture	...	= 9·2 %

Calorific Value Test.

Atmosphere	... ...	16·4° C.
Jacket	... ...	17·4
Calorimeter	... ...	16·2
„ after 2 minutes	...	16·4
„ „ 6 „ burning		18·57
Difference	=	2·17
Cal. value, dry	=	12,610 B.TH.U.
Moisture	=	1,160 „
Cal. value as fired	=	11,450 „

Ash Test (Dry).

Volatile = ·5 gramme	=	25%
Carbon = 1·2 „	=	60%
Ash = ·3 „	=	15%
2·0 „	=	100%

Example.—Sample of Ash.

Calorific Value Test.

Atmosphere	... ...	19·16° C.
Jacket	... ...	17·16
Calorimeter	... ...	16·10
„ after 2 minutes	...	16·15
„ after 6 „ burning		18·44
Difference	=	2·29
Coal + ash	=	13,310 B.TH.U.
− Standard coal	=	12,840 „
·5 gramme ash	=	470 „
		2
1 gramme ash	=	940 „

Ash Test.

Weight before burning = 2 grammes.
„ after „ = 1·634 „
Ash = 1·634 × 50 = 81·7%

A VACUUM-TUBE TRANSMITTER OF CONTINUOUS WAVES.

By J. SCOTT-TAGGART.

The accompanying figure (p. 711) shows a small-power wireless transmitter of continuous waves of very high efficiency, which has been used by the writer with very good results, both in wireless telegraphy and telephony. Ranges of over 200 miles have been obtained when the arrangement has been used for Morse signalling.

A three-electrode vacuum tube is used as the generator of the continuous waves employed. The grid oscillatory circuit consists essentially of an inductance 1 variable in steps and shunted by a condenser 2 of 0.0004 mfd. which is used for fine tuning. A resistance 3 of 10,000 ohms, shunted by a condenser of 0.001 mfd. is connected as shown in the grid circuit, and improves the efficiency of the arrangement. During transmission, the grid assumes a negative potential suitable for operation. The resistance 3 lessens the energy lost in the grid circuit, and also increases the life of the filament of the vacuum tube.

The plate oscillatory circuit includes a variable inductance 4, a tapping key 5, a plate battery 6 of from 400-800 volts, and a by-path condenser 7 of 0.001 mfd., which should be of high insulation, as it is very liable to break down. Retroaction is obtained by utilising both capacitative and magnetic coupling. The former is obtained by the use of the variable condenser 8 connected across plate and grid. Magnetic coupling is obtained by placing the inductance 4 close to the inductance 1. Retroaction

is chiefly obtained by the use of the condenser 8, the loose coupling between 4 and 1 making the circuits oscillate more steadily; this latter coupling may conveniently be fixed.

In the aerial circuit is connected a variometer 9 which enables the emitted wave-length to be varied. The presence of this variometer, and the capacity and inductance of the aerial, make it necessary to arrange that the coil 4 should have much fewer turns than the coil 1.

In order to measure the aerial current a hot-wire ammeter 10 (or flash-lamp bulb) is connected in the earth lead.

On depressing the key 5 an aerial current of as much as 1 ampere is indicated by 10, and the con-

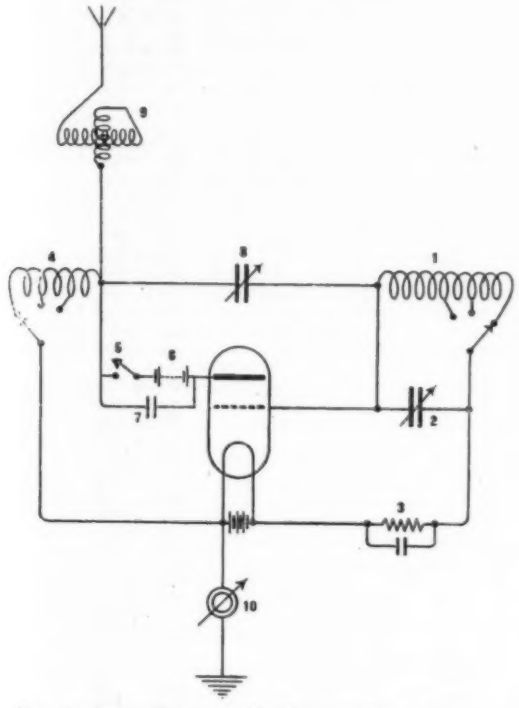


Fig. 1.—Small Power C.W. Wireless Transmitter.

denser 8 is adjusted until the maximum reading is obtained. Tuning is then accomplished chiefly by means of the variometer 9 until the desired wave-length is obtained.

For wireless telephony, a microphone, shunted by about five turns of insulated wire wound on a 4-in. diameter tube, may be connected in the earth lead, the key 5 being kept depressed while speaking.

Hydro-Electric Works in France.—The text has just been published of the law recently passed in France respecting the utilisation of hydraulic power. The law stipulates that no one in permitted to use the energy of tides, lakes and water-courses without possessing a concession or State authorisation. As far as the régime of concessions is concerned this applies (1) to undertakings whose chief object is to supply energy to public services of the State, the departments, communes and public establishments or to authorised associations, and whose maximum power exceeds 150 kw.; and (2) to undertakings whose maximum power exceeds 500 kw. irrespective of their chief object. All other undertakings are placed under the régime of authorisation. The concession is granted according to circumstances by means of a law or decree, and the duration cannot exceed 75 years. At the end of the concession the lands and buildings, machinery and the plant of all kinds constituting the outbuildings erected on the concession shall pass into the free possession of the State. On the other hand, the State has the right of redemption after the expiration of a period of not less than five years or more than 25 years, reckoned from the date fixed for the completion of the works, the conditions being settled by the concession. The authorisations are treated in a similar manner.

CARBON ARCS FOR SEARCHLIGHTS.

By C. C. Paterson, O.B.E., M.I.E.E.; J. W. T. Walsh, M.A., M.Sc., A.M.I.E.E.; A. K. Taylor, M.I.E.E.; and W. Barnett.

(From the National Physical Laboratory.)

(*Abstract of paper read before the* Institution of Electrical Engineers.)

This paper describes a series of experiments undertaken at the request of the Admiralty (D.T.M. Department) and is published by permission. The object was:—

(*a*) To develop the best method of testing carbons in order to prove their value for searchlights.

(*b*) To compare the relative qualities of existing carbons, other than flame carbons, for producing high-intensity searchlight beams.

(*c*) To determine what improvement can be made either in the carbons themselves or in the methods of burning them.

It was at first proposed to make measurements of illumination at different parts of a searchlight beam under actual working conditions in the open, but the sources or error encountered were so great as to cause this method to be abandoned in favour of an indoor method of test.

Amongst the sources of uncertainty of measurements in the open, are the scattering of light by particles of moisture.

Draughts in the searchlight, difficulty in ensuring that the position of the crater is correct in relation to the mirror, and variations in the carbons themselves.

In the laboratory method of test which was adopted, the carbons were examined alone without any mirror. Two quantities have mainly to be considered:—

1. The total flux of light emitted by the carbons alone.
2. The intrinsic brilliancy of the positive crater.

Of these the second is more important for the present purposes, since it is a measure of the intensity in the beam of the projector when adjusted for minimum divergence. If, however, a beam of given divergence is obtained, the intensity will be directly proportional to the total flux of light given by the positive crater, whatever its size or brilliancy. For a given current an increase in intrinsic brilliancy is produced by an increase in current density. Hence improvements in ordinary searchlight carbons are mainly

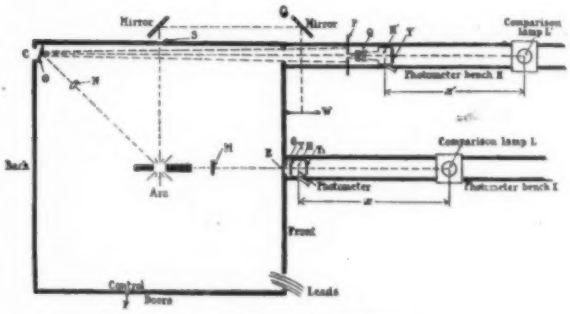


Fig. 1.—Diagram of Apparatus, &c.

obtained by reducing the diameter of the positives if the current is to be kept at the same value. The total flux for a given current also increases with the current density, but apparently at a lower rate.

Flame carbons such as those used in the Beck, Harrison, or Sperry lamps mainly depend on the light emitted by vapour in the arc and close to the positive; these carbons are not considered in this paper.

The light received by the mirror (together with that obscured by the negative carbon) represents some 70 per cent. of the total light emitted from the positive crater.

For the measurement of the total flux, the principle of the integrating globe photometer has been employed, but, following a suggestion of Dr. W. E. Sumpner, a whitened cube has been adopted. A cube has great advantages for projector lamp work.

The integrating cube used has 8 cubic metres capacity (2 metres side), and is illustrated in fig. 1. The arc lamp is entirely controlled from outside the cube. Two images, in direction at right angles to each other and to the axis of the carbons, are projected through the walls of the cube, permitting examination of the arc while burning. Readings are taken simultaneously of crater brilliancy and candle-power. The brilliancy is measured by projecting a magnified image of the front of the crater along a photometer bench.

The cube is constructed of wood, and is mounted on castors. It has doors the full height and width of one side. It is covered inside with asbestos or uralite, and cleaned off so that all inside surfaces are flush and smooth. The roof has a series of sliding shutters 1 ft. wide, so that any required opening can be used. It also has a series of shutters which work horizontally along the centre of the front of the cube, one of which carries the small

translucent window E. A similar series of shutters is recommended for ventilation adjustment in the back wall of the cube.

All the inside surfaces are treated with three coats finished with gelatine and zinc white. It is advisable to whiten also any objects which have to be in the cube.

The diffusing window E consists of two plates of special colourless glass, ground on both surfaces, and fixed so that the inside face is flush with the surface of the cube wall. Close to the window at G is fixed an iris diaphragm with about 70 mm. opening,

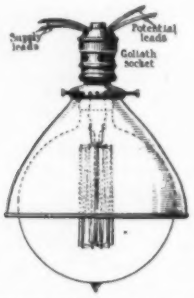


FIG. 2.—STANDARDISED LAMP AND HOOD.

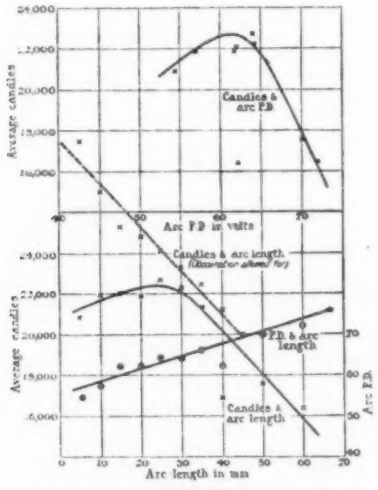
permitting of adjustment of the illumination on the photometer to a value which will enable the standard lamp to work on a convenient part of the photometer bench. The diaphragm opening must not be changed in the course of an experiment or of a calibration, nor must the distance of a photometer head from the window be varied. The illumination at the photometer is, therefore, not strictly proportional either to the area of the window or to the inverse square of the distance.

The photometers H, H′ are of the Lummer-Brodhun type. In order to reduce the illumination at the photometer when the arc lamp is burning, a neutral-tinted gelatine filter, T, is placed between the window and the photometer. The transmission value of this filter must be known accurately, as it is removed and another substituted during the calibration of the cube.

A bluish filter, T_1, is inserted between the photometer and the comparison lamp to render the colour of the light from the latter similar to that from the cube when the arc lamp is in use. This filter has also to be removed during the daily calibration.

The comparison lamps, L, L′, are ordinary-vacuum tungsten-filament lamps operating at about 0·68 candle per watt mounted on carriages which work along the photometer tracks.

The opaque disk M is about 10 cm. in diameter, and is placed in the direct line between the arc lamp and the window E, and



G.E.C. "Apostle" carbons (+ ve 28 mm., — ve 16 mm.) impregnated, at 180 amperes.

FIG. 3.—VARIATION OF CANDLE-POWER WITH POTENTIAL DIFFERENCE AND ARC LENGTH.

approximately midway between them. No direct light from the source must fall on the window, which only receives light from the inside walls of the cube,

The lens N projects an image of the front of the crater (after reflection from the mirror O) through an opening in the cube, on to the white screen P.

The mirror O is a plain back-silvered 4-in. diameter mirror mounted so that it can be tilted or turned about a vertical axis. The operator obtains access to the adjustments through the opening C.

The screen P is a white matt celluloid sheet 3 mm. thick and about 20 cm. square, fixed to a frame which carries the lens Q. P, Q, and the photometer H′ are mounted together and rigidly attached to the photometer track. The screen P has a circular aperture of 10 mm. diameter, bevelled off to a sharp edge. The lens system Q consists of two negative lenses of 16 and 20 diopters.

T′ is a bluish colour filter.

The optical system comprises the crater, the lens N, the mirror O, and the screen P, and has the following dimensions:—Crater to N, 828 mm.; N to P, 3,444 mm. The important dimension is the distance from N to the screen P on which the image of the crater is focused.

The lens S casts an image of the arc, viewed from the side, on to the translucent screen W *viâ* the two mirrors shown.

The cube has to be calibrated in absolute measure for candle-power, and the other optical system for crater brightness in candles per sq. mm. The combined constant of the cube and photometric apparatus is determined by burning in the cube a lamp of known average candle-power (M.S.C.P.).

The standard lamp used for calibration of the cube, shown in fig. 2, is a large 240-volt, 1,000-watt, vacuum-type lamp, made up with a fairly close-fitting opaque hood, with an internal reflecting surface. The distribution of light from this lamp is found to agree very closely with the Rousseau diagram for the arc lamp.

When calibrating the cube, the arc lamp, and all other accessories, are left in place, and the standard lamp is supported with its axis horizontal in place of the carbons, in such a position that the light is emitted towards the inside back wall of the cube. The lamp illustrated gives an average candle-power of 422 candles at 240 volts, with its hood in position.

The burning of the arc lamp inside the cube gradually causes a discolouration of the white walls, and it is, therefore, necessary to determine the constant of the cube each day. It has been found convenient to use an ordinary tungsten lamp without hood for the daily calibration, correcting the result by the previously determined ratio between the results given by the two lamps.

The comparison lamp I is an ordinary grid filament vacuum lamp operating at 200 volts. During calibration it is at a distance of approximately 2,000 mm. from the window E.

The probable error in the value assessed for the constant of the cube may be put at 3·5 per cent., and to this must be added, for any one carbon, the probable error of the series of observations upon it.

In Table I is given a list of the carbons which have formed the subject of this investigation. The first seven were originally supplied for a comparison of their light efficiencies with that of a special

TABLE I. (ABBREVIATED).

No.	Description of positives.	Diameter.		Current, 0·2 amp. per sq. mm.	Average candles, 0·2 amp. per sq. mm.	Candles per ampere, 0·2 amp. per sq. mm.	Crater brightness candles per sq. mm., 0·2 amp. per sq. mm.	Candles per watt, 0·22 amp. per sq. mm.
		Positive.	Negative.					
	Uncoppered.	mm.	mm.					
I	Solid ...	20	9	63	6,300	100	160	1·8
II	Solid ...	22	12	76	7,600	100	152	1·7
III	Imp'd, cored	23	12	83	8,550	102	152	1·9
IV	Cored ...	24	16	91	9,700	106	161	1·6
V	Cored ...	28	14	123	14,100	114	162	1·9
VI	Cored ...	32	16	161	18,800	117	160	1·7
VII	Solid ...	38	20	227	26,000	114	163	—
	Coppered.							
VIII	Solid ...	28	16	123	11,800	96	139	1·7
IX	Impregnated	28	16	123	13,000	106	142	1·9
X	Solid ...	28	16	123	14,500	118	150	1·8
XI	Imp'd, solid	28	16	123	11,400	92	138	1·6
XII	Cored ...	28	16	123	9,800	80	130	1·6
XIII	Cored ...	28	16	123	9,100	74	174	1·6

impregnated carbon developed by Messrs. W. Heape and H. B. Grylls, and described by them in Patents Nos. 126,673 and 128,057 of 1919. Subsequently, and as the result of conclusions drawn from these tests, a series of carbons was specially made up and supplied by the General Electric Co., Ltd., with the object of obtaining the best type of carbon for an average burning current of 200 amperes.

Tests were also made with the electromagnetic control device developed by Captain Yorke, of the London Electrical Engineers.

The lamp in which the carbons were burned was an old Crompton type for the 90-cm. searchlight with automatic and hand-feed gear. During the test all feeding was done by hand by means of a chain and sprocket wheel driven from outside the cube.

It was at first thought that the candle-power would vary both with the potential across the arc and with the current, but a careful investigation showed that while the potential difference and the arc length increased or diminished together, a large change in these quantities produced no sensible alteration in the average candle-power.

Fig. 3 shows a series of measurements of the average candle-power from 28-mm. impregnated "Apostle" carbons when taking 180 amperes at arc potentials varying from 55 to 72 volts. The points corresponding to arc lengths less than 35 mm. cannot be said to indicate a definite variation of candle-power in either direction. It is true that for different arc lengths there are different degrees of obscuration of the positive by the negative carbon; it is of interest, however, to note that if the obscuration be allowed for,

and a curve of average candle-power be continued as indicated in the dotted line, the candle-power increases as the arc length is reduced. Mrs. Ayrton ("The Electric Arc," page 327), also found that with large currents the candle-power increased as the arc length was diminished. Hence the maximum candle-power in any direction not obstructed by the negative is greater the shorter the arc length.

The fact that candle-power is virtually independent of the arc potential results in a simplification of the problem since one important variable is thereby eliminated. The arc length can, therefore, be adjusted to whatever point gives smoothest running, with the proviso that it should not be short enough to cause excessive obscuration, say, more than 7 per cent.

The points on the individual curve-sheets showing the relationship between crater brightness and current, have been connected by a straight line in order to indicate the general rise of brilliancy with increase of current, but the results are not sufficiently accurate to justify any assumption as to the true form of this relationship.

(To be concluded.)

Discussion.

Capt. Im Thurn, on behalf of the Admiralty, in opening the discussion, thanked the authors for the valuable work that had been carried out at the request of the Admiralty. The U.S.A. authorities were now co-operating in this work; all the results obtained at Teddington had been confirmed by trials carried out under working conditions on board H.M.S. *Vernon*. It appeared to be desirable to use a yellow light for searchlight beams, as this was apparently not absorbed to the same extent as was the case with the bluish light obtained with higher current densities. It was now proposed to carry out similar tests with flame arcs at Teddington.

Mrs. H. Ayrton congratulated the authors on their work; she was particularly interested because she had carried out herself two very similar researches. In this connection it was of interest to note that the authors had been supplied with seven sets of carbons, all of British manufacture, whereas she had had only three sets, two being of foreign and one only of British make. In her opinion it was not possible to use large currents and get a silent arc; heavy current meant hissing. In the past the Admiralty did not realise the conditions that actually obtained. It had been the practice to specify certain things entirely without regard to whether it was physically possible to carry out in practice the conditions laid down. The shape of the carbons was of importance with regard to quick starting. If they were not pointed in the correct manner, the arc would have to be allowed to burn for some time before the right shape was obtained. This fact the Admiralty did not seem to realise, and the variety of results, which in her opinion was excessive, as shown by the authors' diagrams, could be attributed to the same cause. She was surprised to learn that the authors had anticipated an increase in candle power with an increase in potential difference. At Chicago in 1883 Prof. Ayrton had demonstrated that an increased P.D. did not result in any increase in the C.P. The curves given at the end of the paper were, in her opinion, fallacious when considering arcs of short length. She had dealt with this point at the Exposition of 1900 at Paris. It did not seem to be realised that it was of importance that the carbons should burn away at such rates as to ensure that they both remained of the same length. Mrs. Ayrton exhibited a pair of carbon stumps, which, she explained, had been burnt in special holders invented by herself, and it was seen that the rate of consumption had been such that the remains of both electrodes were exactly the same length.

Capt. Yorke criticised the methods of testing that had been adopted at Teddington; his view was that there was only one way of comparing carbons, and that was by actually burning them in the lamp in the open. He then spoke of his experiences in the field, and the methods of comparison adopted, which consisted in taking numerous records under actual working conditions in the open. It was a curious fact that some carbons burnt well during a certain test, but when the test was resumed at a later date and under apparently similar conditions, their behaviour was entirely different. He did not agree with the objections set out in the paper relative to open-air testing; in his opinion most of the difficulties could be overcome. He also questioned the accuracy of the author's remarks regarding the invention of copper-coated electrodes.

Mr. H. B. Grylls thought that the most interesting curves given in the paper were those relating to the variation of candle power with potential difference and arc length (fig. 3). It was desirable, he thought, to have a short arc to give an intense crater, as it was under these conditions that the beam was the most intense. Moreover, a shorter arc implied a smaller potential difference, and the latter condition rendered manipulation very much easier. Mr. Grylls then referred to the advantages of impregnated carbons as invented by Mr. W. Heape and himself, and said that it was possible to have a lower potential difference when such carbons were used, and especially if they were cored as well. With regard to the previous speaker's remarks about copper-coated electrodes, he (Mr. Grylls) believed that they were first made in Russia. Concerning the testing methods adopted at Teddington, in his opinion it should not be a difficult matter to test beams of lengths up to about 500 yards in the open air without introducing serious objections. The authors had done good work, which would be welcomed by private investigators; it was satisfactory to know that one aspect at least of the problem had been cleared up. In conclusion, he hoped that the good work would be continued, and more done, as was foreshadowed in the earlier part of the paper.

Lieut.-Com. H. T. Harrison thought that the total luminous flux was the thing to aim for; he objected to the measurement of the total spherical candle power on the ground that only some 20 per cent. of it was usefully utilised by the mirror. The intrinsic brilliancy and the actual diameter of the crater would afford more reliable means of comparison, but they were difficult values to define, because the intrinsic brilliancy was not the same at every point on the crater. He quite appreciated the difficulties encountered in open-air testing, and results so obtained could not be applied to the measurement of luminous flux on the mirror. On the whole, he regretted that the methods of testing described in the paper had been adopted.

Mr. M. Solomon explained that the actual work of comparing searchlight carbons was a very complex problem indeed, and, in his opinion, it was no use whatever trying to tackle the problem as a whole. It could only be done by examining each component separately, as had been done in this paper. Credit should be given to the authors for having isolated and cleared up one part of the problem in consequence of which future work would be facilitated. His point of view was that the composition of the carbons themselves actually made very little difference; the diameter and shape of the crater were the things that needed examination.

Prof. G. T. MacGregor-Morris agreed with the last speaker that the paper had cleared up certain parts of the problem. With regard to measurements of the beam taken in the open air, and the interference by mist, it was not stated at what height from the ground such measurements were made. In Bushy Park, Teddington, surrounded by trees and grass, there would naturally be much mist, but conditions would be very different were the tests carried out along a hard, dry roadway, for instance. Another point was, had the carbons been thoroughly dried out before use, and had the arcs used been really silent ones? To avoid hissing he had found it necessary to heat the carbons to a red-hot temperature in an airtight oven, and allow them to gradually cool down again before they were used. With regard to the tests actually carried out, he thought it desirable to do away with the colour screens that had been used, and also, if possible, the mirrors as well.

Mr. A. P. Trotter said that the intrinsic brilliancy was the only factor that need be considered; a larger crater made no difference to the candle power, as it was only the light emitted from a definite portion of the crater that was usefully employed. Comparison should, therefore, be made of the intrinsic brilliancy of this particular portion. Concerning the measurement of total flux by the integrating globe photometer, he appreciated the authors' arguments in favour of the adoption of a whitened cube in place of a sphere.

Major Edgcumbe said that to fully appreciate the value of the paper, one had to consider the surprisingly small amount of data available at the War Office a few years ago. With regard to searchlight work in the forces, in his opinion the electromagnetic control device developed by Capt. Yorke was the only possible thing for field work, where the conditions were anything but good, and the operator far from skilled. Turning to the penetrative power of the beam, he said that he made the suggestion for what it was worth, but it appeared to be more efficient to employ a white light in fog (water vapour) and a red light in smoke (solid matter).

Mr. Angold suggested that beam comparison could be made by focusing the beam on a white disk of a definite diameter at a short distance, and taking the candle-power measurements from the disk. When a short arc was used the light was emitted through a very small angle, which would account for the apparently higher crater brilliancy and intensity. He recalled a case in which when the carbons were looked at sideways the point of one carbon appeared to be actually inside the crater of the other. Personally, he had a theory, which was shared by others, that the point of one carbon was cooled by a negative stream given off by the other.

Mr. C. C. Paterson, replying briefly to the discussion, thanked members for the way they had criticised the paper; some useful suggestions had been made, and criticism was always helpful. He also thanked those speakers who had defended the indoor methods of testing adopted at Teddington. In his opinion, the results of open-air tests would be very unreliable unless a very large number of observations were made. The object aimed at was high power of penetration. It was not possible to reply to the discussion fully in the time at his disposal, the authors would, therefore, postpone their joint reply for publication in the Institution *Journal*.

Australian Electrical Imports. — During the year 1918-19, the total amount of electrical material imported was £607,747, as compared with £181,214 in 1917-18.

LEGAL.

Edwards v. Hewlett.

In the City of London Court, on November 25th, this case was mentioned to Sir John Paget, K.C., Deputy Judge. It was a claim by Mr. Ernest E. Edwards, electrical engineer, Cullum Street, E.C., against Mr. Harry Hewlett, publican, 22, Dock Street, Stepney, to recover £39 14s., balance of £45 9s. for electrical wiring, supplying lamps, and for other electric fittings at the defendant's public-house.

Mr. Ellis Hill, plaintiff's counsel, said that at the trial the defence set up was that the plaintiff had contracted to do the whole of the work for £15. That failed, and the judge referred the question of amount to Mr. J. H. Scott, Dock House, Billiter Street, who was to survey the premises, and say how much was to be paid by the defendant. The report was by no means clear. It said that after careful perusal he found that in examining the value of the goods supplied for work done, £35 would amply cover the same with the exception of the following item dated December 20th: Wiring four brackets in the bar (which was excessive and out of ordinary practice), £11 5s. He recommended the plaintiff to revise the charge. There was also a second item to which he had to draw attention, viz., the last one on the bill, which referred to the tube connected to an outside bracket, and for which a charge of £10 had been made. A screwed tube should have been employed, and not the close joint which he considered inadequate for the better preservation of the cable. Finally, there was a charge of £11 18s. 6d. for half-watt and Osram lamps, which defendant claimed to have returned as unsuitable.

Mr. O'Malley, defendant's counsel, said that the report was no report at all. On the face of it, it was bad.

The Deputy Judge said that the report was not worth much. It was ridiculous to ask him to act upon it. The arbitrator said that the claim was excessive, and that if the parties could not settle it they must go back to the Court. The report was of no use to him.

The plaintiff was called to substantiate his claim, and said that the defendant sent him 18 old lamps which were useless and now seemed to want to be paid for them. In cross-examination, he admitted that he had had business relations with Mr. Scott.

The Deputy Judge did not think there was anything in that. He would send the case back to Mr. Scott to report on item by item. He had had his fee and could not have another.

Farrant v. County of London Electric Supply Co., Ltd.

At the City of London Court on November 25th, the hearing of this case was resumed, when a long and very interesting legal argument took place. Henry Knott, store clerk to the defendants for many years, was called. He said he had distributed copies of the rules to various workers, including Farrant, which showed that in the circumstances he had no business to be working where he was. The Deputy Judge held that that was not sufficient to fix the deceased with direct knowledge of the rules.—Mr. Scanlan urged that Farrant ought to have known that the place where he was working was dangerous, and that the conditions made it prohibitive. He did not do the work under the supervision of anyone who had superintendence for whom the defendants were liable. The case was one of very great importance to the electrical world.

The Deputy Judge said having regard to the importance of the case he would reserve his judgment and look thoroughly into the law on the matter.

Davis & Stephens v. Eastern Telegraph Co., Ltd.

An action in respect of a cargo of telegraph cable came before Mr. Justice Roche in the Commercial Court of the King's Bench Division on November 26th and 27th. The plaintiffs, of Plymouth, were owners of the ketch *Lizzie*, and their claim against defendants was for damages for the alleged breach of a charter party dated April 15th, 1919, by which they chartered the ketch to the defendants for the carriage of the telegraph cable from East Greenwich to Plymouth.

Mr. F. D. Mackinnon, K.C., opened for the plaintiffs, whose case was that the cargo was improperly loaded, and the ketch was seriously damaged, and was obliged to accept salvage services into Ramsgate Harbour, where she had to be repaired, and was unable to proceed on the remainder of her voyage from Ramsgate to Plymouth except under tow.

Defendants denied negligence, and alleged that the ketch was unseaworthy in that she was in a leaky condition.

Mr. John Palmer stated that he was master of the ketch *Lizzie* at the time, and in April, 1919, he went to Enderby's Wharf, East Greenwich, to load the telegraph cable. A platform was built, but witness did not consider it was safe to carry the cable. He was assured, however, that it was all right, and loading was proceeded with, but suddenly there was a collapse on the starboard side. The timber broke and the cable sagged down about nine inches. Some struts having been put in the loading was finished, and the ship sailed. The weather was fine and all went well until they got off Southend, when the wind came up south-east and chopped round to south-west. The struts were then "all over the show," and the cable went down to a firm bearing on the bilges of the ship. When off Foreland the ketch rolled heavily and made water. It was blowing a gale at the time. After pumping it was agreed to take the vessel into Ramsgate. The leaky condition of the ship, said witness, was caused by the platform carrying away and the cargo shifting down to the bilges of the ship.

Mr. William Moses, surveyor at Ramsgate, said he surveyed the ketch *Lizzie* at Ramsgate in May, and he came to the conclusion that the cargo was improperly loaded. He had never seen cable loaded on a platform like this before.

Evidence was given by Mr. David Banks, surveyor, of Plymouth, who expressed the opinion that the platform was not sufficiently strong to carry the cable.

Further evidence having been given for plaintiffs, Mr. Y. B. Petley, marine officer of the Telegraph Construction and Maintenance Co., Ltd., gave evidence for the defence. He said he was one of the officers responsible for the stowage of the cable in the *Lizzie* when she came to the wharf at East Greenwich. A platform was constructed, and in the course of loading three of the bearers broke. At that time six miles of cable (54 tons) had been loaded. After the completion of the repairs the platform was perfectly safe. Another 30 odd tons of cable were put in, making 87 tons in all.

His Lordship, in giving judgment, said the plaintiffs had wholly failed to satisfy him that they were entitled to succeed. He was satisfied that nine-tenths of the claim had nothing whatever to do with the loading of the ship. There must be judgment for the defendant company with costs.

Sentence on Manchester Corporation Tramway Official.

Mr. Justice McCardie, last week, sentenced J. W. Hewitt (43), who had pleaded guilty to falsification of the books of the Manchester Corporation Tramways Department, to three years' penal servitude. Counsel made a strong appeal on prisoner's behalf, but the judge said he could not overlook the seriousness of his violation of trust. His dishonesty was grave, ingenious, deliberate, and prolonged.

Electrical Powers for Skibbereen Gas Company.

In the Chancery Division at Dublin, last week, before the Master of the Rolls, Mr. H. J. Maloney, B.L. (instructed by Mr. J. T. Wolfe, solicitor, Skibbereen, Co. Cork), applied on behalf of the Skibbereen Gas, Light & Coke Co., for an order confirming a special resolution of the company altering the existing memorandum of association and increasing capital to enable the company to manufacture and supply electric light and fittings. The company owed no money, and had always paid dividends. There was a general demand amongst the people of Skibbereen for electric light for the town. There was no objection to the application, and the Master of the Rolls granted the order required.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Coal Prices.

All suppliers and consumers of coal, both domestic and industrial, must have been thunderstruck at the latest hastily-arrived-at decision of our Government.

When will meddling politicians learn to leave industry alone to fight its battles, and put their house in order? It is known and admitted that not a single member of the Coal Controller's staff had any knowledge of the political bomb which was to be thrown in the House of Commons on Monday last.

It is impossible to get any exact particulars of what the Government's intentions are. We are advised by the daily Press that coal for the generation of lighting, gas or electricity, is to be reduced by 10s. per ton; but at the same time, it is further stated that industrial coal is not to be reduced. What is to be the position of the gas and electrical undertakings who supply industrial users? Are they to be subsidised?

It is understood that railway companies are not to benefit, consequently electrically operated train services, such as the Underground, Great Western, London & North-Western, and London-Brighton will not have their generating costs reduced. Tramways are on a par with railways, and consequently their coal will presumably be charged for at the higher rate.

In common with all tramway undertakings, the L.C.C. has increased its fares to meet additional fuel costs. What will be the exact position of the large electric power supply companies, such as the N.E.S., Yorkshire Power Co., London Electric Supply Corporation, and North Metropolitan Electric Power Supply Co.? All of these companies supply power

to either or both railways and tramways. How does the Coal Controller propose that these concerns should be treated? Are they lighting? Are they power? Or are they tramway suppliers?

The recent action of the politicians will probably be received with not unmixed feelings by the gas and electric supply authorities who have more than benefited by the increased fuel charges, and who will have to reduce their selling prices. Rumour also has it that certain undertakings have taken credit to themselves by increased value of coal in stock.

The sudden action of the politicians will indeed have far-reaching effects.

Power.

November 26th, 1919.

The Lay-out of Motor Starters and Switchgear.

I was interested to see Mr. James Walker's remarks on the lay-out of motor and switchgear in your issue of the 21st inst. I conclude that they refer, more especially, to conditions in which the standard pedestal or wall type is ruled out from the point of view of the additional first cost. Under such conditions I have usually found that economy of space is also of vital importance, and one has to tuck away the motor starter as best one can. It seems to me better to have each piece of apparatus separately under the like conditions, and if practicable make the angle-iron frames locally.

I should like to know Mr. Walker's experience as to when the ordinary D.P. switch and fuse reaches its limit, and when the D.P. circuit breaker takes its place, for controlling low tension power circuits, either when entering a building or controlling the motor itself. My experience is that when one gets above about 600-800 amperes the D.P. switches and fuses one usually meets, are not sufficiently well made, or the contacts and fixing terminals heavy enough. But I am still in greater difficulty to find a suitably enclosed D.P. breaker at a reasonable price.

W. J. Webber.

Surbiton, *November 26th*, 1919.

Electric Heating Problems.

Your editorial article in this week's issue *re* electric heating problems is most opportune, and I quite agree that few electrical engineers and contractors realise the enormous variations in heating requirements that are governed entirely by building and structural conditions.

The rule generally laid down in catalogues of electric fire manufacturers, and also in fact in many handbooks, is that 1 to 1½ watts per cu. ft. is a good figure to take when deciding upon the size of fire for a room. Whilst this figure may be safe for a room situated in the best position, it is far too low in other cases. Two examples will illustrate my point. In both cases the rooms are 14 ft. by 12 ft. by 10 ft. high with 9 in. main walls and 4½ in. partition walls. The temperature of the outside air is taken at 32 deg. F., and the required inside temperature at 60 deg. F. Each room has a 6 ft. by 6 ft. window in the main wall.

Case I has a room facing south—only one outside wall, and is situated next to a kitchen in which the temperature is assumed to be constant at about 50 deg. F. Taking into account all radiation losses through walls, ceilings, window, and floors, and assuming only one change of air per hour—the B.TH.U. per hour necessary to maintain an internal temperature of 60 deg. F. is approximately 7,000, which when converted into watts gives an electric fire requirement of approximately 2,000 watts.

Case II is a similar room, but the window faces north, and in addition French windows 6 ft. by 8 ft. lead into a garden facing east. To maintain the required temperature in cold weather requires 10,000 B.TH.U. per hour—equivalent to an electric fire of approximately 3,000 watts.

Calculating upon the general basis of 1½ watts per cu. ft. the fire consumption in each case would have been taken as 2,100 watts, and a 2-KW. fire probably installed.

Whilst realising that these are extreme cases, I think they prove conclusively that, in order to obtain the best and most efficient results from electric heating, the services of the expert should be called in to co-operate with the architect, just in the same manner that lighting problems are being so scientifically dealt with.

Chas. G. Huntley, A.M.I.E.E.

London, S.W.
November 25th, 1919.

The Cost of Living in India.

A word of warning to any readers who may be disposed to accept a post in India or Burma.

In common with the rest of the world, the cost of living in India has risen enormously, yet posts are still advertised periodically at an initial salary of Rs.300 with annual increments of Rs.25 per month, and in many cases the rupee is stated to be worth 1s. 10d. This is the rate of exchange, but the purchasing power of the rupee is far less now than it was when its nominal value was 1s. 4d.

When I came out to India seven years ago on Rs. 300, I thought my fortune was made, but I am sadder and wiser now. The conditions out East compel a European to keep up a certain amount of "style," but even though the said style be of the most meagre description, Rs.300 IS A STARVATION WAGE. I speak feelingly when I advise single men to refuse anything less than Rs.500 a month, whilst no married man should accept less than Rs.800, if he is to live debt-free.

Two other items should be insisted on, namely, free medical attendance (which is a heavy item even for a small dose of fever), and free FURNISHED quarters or an allowance of not less than Rs.100 per month in lieu thereof. Rents are enormous, and the last state of the man who comes out here on less than the amounts aforesaid, will be worse than the first.

Adsum.

India, *November 4th*, 1919.

The New Cable Standards.

With reference to the timely and useful article by Mr. D. S. Munro in your issue of the 14th inst., may I point out that .001 sq. in. is not 1 sq. mil as implied, but 1,000 sq. mils.

F. W. Andrews.

London, S.W., *November 29th*, 1919.

It is a pity that Mr. L. B. Atkinson has seen fit to reply to a part only of the letter from "Contractor" in your issue of November 21st. He apparently suggests that such matters as prices should be discussed with individual members of the C.M.A., but since all C.M.A. firms quote the same prices, surely Mr. Atkinson could, even if only for the sake of uniformity, reply on behalf of all his members.

As it happens, I raised this point about the minimum size of wire to take the place of the old 1/18 with a representative of one of the leading C.M.A. makers. He gave me his definite opinion that the difference being small, the .0015 size would fulfil I.E.E. requirements. As I was not satisfied with this I dictated, whilst the C.M.A. representative was present, a letter to the secretary of the I.E.E. asking for a ruling. I was surprised to receive a reply that he would have to refer to the chairman of the W.R. Committee, followed by a further communication dated six days later that 0.0015 is permissible in connection with the wiring of fittings only.

The fact that the official secretary of the I.E.E. was unable to answer such a simple question off his own bat scarcely tallies with Mr. Atkinson's statement that "The I.E.E. have agreed the new standard sizes." His further statement that "no doubt the Wiring Rules Committee will amend their rules" only goes to prove still more that these new sizes were "rushed" through to raise prices. The net result of this ruling is that in the vast majority of wiring installations the cheapest size of wire which can be used to conform to I.E.E. rules is 3/.029, which costs £25 4s. 6d., as against £18 13s. 8d. for the old 1/18. I would suggest that contractors should study these figures in conjunction with those you publish showing the dividends paid by C.M.A. firms.

E. Arthur Pinto, A.M.I.E.E.

Ramsgate, *December 1st*, 1919.

Combined Lighting and Ignition Set.

I notice in the current number of the ELECTRICAL REVIEW your article on the International Motor Car Exhibition, under the sub-heading Rotax Motor Accessories Co., Ltd., the following paragraph:—"And a combined lighting and ignition unit similar to the C.A.V. machine."

This peculiar wording gives one the impression that the ignition dynamo made by Messrs. Rotax has been copied from the C.A.V. product.

I trust this letter will go a little way towards removing that impression. I believe it is a fact that Messrs. Rotax had supplied a number of these combined ignition and lighting dynamos and entered into a large contract before the C.A.V. machine was designed.

I am not desirous of detracting in any way from the excellent products supplied by Messrs. C. A. Vandervell, but I do think that your articles should be so worded as to be incapable of placing in a false light Messrs. Rotax Motor Accessories Co., Ltd., who were the pioneers—being the successors of the Leitner Electrical Co.—in the young days of car lighting, and who are still the pioneers in its latest developments. It has often struck me that the technical Press (both electrical and motor car) do not do justice to Messrs. Rotax. Why this is I cannot say, because their product will stand comparison with any in its high-class manufacture, and there is no lighting and starting set which is its superior in efficiency.

For the **Rotax Motor Accessories Co., Ltd.**
H. F. PARISH, *Chief Designer.*

London, N.W., *December 1st*, 1919.

[Our apologies are due to Messrs. Rotax. Needless to say, we had no intention of casting any such reflection on their ignition dynamo, which, as they claim, was a pioneer machine, and certainly was not copied from another. We know of no reason why our correspondent's products do not receive justice, as he alleges; we, at any rate, have no bias in the matter.—EDS., ELEC. REV.]

THE ELECTRICITY SUPPLY BILL.

On Tuesday last week Mr. Shortt accepted an amendment providing that no order should be made authorising the abstraction of water from any dock without the consent of the owners thereof. An amendment depriving owners of water-powers of the right to compensation was rejected by 236 votes to 47. Mr. Shortt accepted an amendment protecting authorised suppliers of energy in any form other than electricity from competition by district electricity boards, &c., and a Government amendment was inserted in the compensation clause ensuring that service with the Colours should rank as service with authorised undertakers for the purpose of assessing compensation. An amendment limiting the financial powers of the Commissioners was rejected, and amendments proposed by the Government providing for an appeal to the Board of Trade when authorised undertakers were required to change their system of supply, and providing that a special order under Section 28 should not come into force until approved by resolution of each House of Parliament, were agreed to. The Report Stage was then concluded, and on Wednesday the third reading was passed.

A statement has been issued on behalf of the Provincial Electric Supply Committee of the United Kingdom, which represents 150 electric supply companies holding provisional orders, with regard to the Bill.

After giving a *résumé* of the history of legislation on the subject, the statement says:—

It is recognised that the Electricity (Supply) Bill, 1919, now before the House of Lords, aims at the reform of electrical legislation to conform to modern conditions, and many of its provisions are welcomed as removing some of the restrictions which have hampered the progress of the industry.

The Bill as passed by the Lower House provides for the delimiting of electricity districts, and for setting-up alternative administrative bodies, joint electricity authority, or district board, for dealing with the supply of electricity within any district delimited.

The first, a joint electricity authority, is of a co-operative character, formed by the existing authorised undertakers with, or without, representatives of other bodies and classes interested. This scheme constituting joint electricity authorities may be one formulated by those parties, approved with or without amendment by the Electricity Commissioners, or it may be a scheme formulated and imposed by the Commissioners. The provisions of the Bill in respect to these schemes are very elastic, so that the Commissioners will be able to adapt the schemes to the circumstances of each case. Joint electricity authorities may be authorised to purchase compulsorily all or any of the generating stations and transmission lines within their districts, but they are not to be empowered to purchase any other part of the undertakings without the consent of their owners, *i.e.*, by agreement.

The terms for the compulsory purchase of the generating stations and main transmission lines are the same as those commented on below, and are considered to be most unfair by the owners, having regard to the terms of the Act of 1888 upon which their capital was subscribed.

The other type of organisation, the District Electricity Board, is only to be established if the Commissioners find that no satisfactory scheme for a joint electricity authority can be set up. These District Electricity Boards will have very wide powers. They will become authorised undertakers for the whole of their districts, and may, in some measure, compete with the existing undertakers. The District Electricity Boards are to be the authorities for the generation and bulk supply of electricity. The authorised undertakers will be the retail distributors.

These District Electricity Boards are empowered to take over all or any of the generating stations and main transmission lines within their districts on terms of purchase set out in the present Bill, clause 7, which the companies consider unfair. It is a serious departure from the terms of the Electric Lighting Act, 1888, upon which terms they obtained their capital and set up their undertakings. The terms of purchase for generating stations in the present Bill are shortly, the cost of the stations, less depreciation. The terms of the Act of 1888, section 2, are "fair market value at the time of purchase," without allowance for goodwill and prospective profits. These terms apply to the whole of the undertaking at the expiry of the 42 years, or other tenure. At the present time, the "fair market value" of the generating stations is from twice to three times the pre-war value, and as the greater part of the expenditure was incurred in pre-war times, the "cost less depreciation" terms will mean that in money value the owners will receive probably less than one-half of what they would obtain under the purchase clause of the Act of 1888. Apart from the question of purchase price, the owners will lose the goodwill attaching to the generating stations for the unexpired balance of their tenure, which is a valuable asset.

The Government answers to the companies' contentions and the rejoinders thereto are:—

1. That to pay for the stations on a present market value basis would be to give the companies a war profit, and to overload the capital accounts of the joint electricity authorities or district boards.

The companies' answer to this is that they do not seek anything in the nature of a war profit, but they equally object to the capital being put at a fictitiously low value at the expense of their shareholders. The compulsory purchase of the companies' generating stations before the expiration of their tenure under the inadequate terms set out in the Bill is a clear breach of the Parliamentary bargain made under the Act of 1888.

2. That there is no goodwill value attaching to the stations as such. The companies make their profits on the distribution business, that is, by their sales. They will be entitled, under clause 7, sub-section (5) of the Bill, to receive from the District Boards as much electricity as their existing stations can supply, at a price not higher than they could have produced it themselves.

The companies' answer to this is that the costs of generation have been steadily reduced in the past by improvements in their stations, and that to deprive the companies of the opportunity to make further improvements of the same kind is to deprive them of part of the goodwill of their undertakings during the tenure guaranteed to them by Parliament. The obligation on the part of the District Electricity Boards to give bulk supply on the terms set out in chuse 7, sub-section (5), above referred to, offers nothing for this opportunity of continued improvement. Further, they are not to participate in the benefit of future economies by the operations of the District Electricity Board, because by clause 25 of the Bill the Commissioners are directed so to regulate prices that the whole benefit of reductions in the cost of generating is to enure to the consumers.

3. That the companies whose generating stations are taken over are offered by clause 12 of the Bill the option, within two years, of transferring the whole of their undertakings to the District Electricity Boards, on the terms of receiving the capital expenditure on the undertaking properly standing in the books of the company as certified by an auditor appointed by the Board of Trade, less the amount received for the generating station, so that if they find themselves unable to continue in business and make reasonable profits under the new conditions, they can call upon the District Board to purchase the whole undertaking on the terms above mentioned.

The answer to this is that while this provision is certainly some protection, it obviously will only operate in the case of companies who find themselves so much prejudiced that they prefer to sacrifice whatever chance they may have had of making more adequate profit in the last years of their tenure to compensate them for the lean years of the past. It is obvious, therefore, that the protection offered by clause 12 is entirely illusory, and does not by any means meet the needs of the situation. It has also to be remarked that the tendency of this provision is to force private enterprise to withdraw from the distribution of electrical energy under legislative pressure. Considering that electric supply was initiated by private enterprise and that these pioneer undertakings had a very hard and unremunerative time in the early part of their careers, such treatment is neither just nor expedient.

The companies consider that the Bill can be greatly improved without damage to any public interest, and they will endeavour to have amendments considered by the House of Lords.

Commenting on the Bill in its present form, *The Bulletin* of the Federation of British Industries states that it now contains those features which the Electric Power Committee of the Federation decided to be essential features of any scheme for the co-ordination of electricity supply. They may be briefly enumerated as follows:—

(1) Voluntary co-ordination as a first measure: This principle has now been accepted in the shape of Joint Electricity Authorities.

(2) Freedom for manufacturers to set up their own generating plant. This has practically been granted; and finally,

(3) The appointment, with judicial and advisory powers, of Electricity Commissioners.

To make a success of the Bill, the five Commissioners must possess every virtue and be capable of forming sound judgments on all matters from high finance to eelctric globes. Incidentally they must be able to buy at high prices and produce cheap electricity.

Practical men are doubtful of the successful application on an economic basis of the main principles in the Bill. They consider that the financial arrangements are such as to preclude the possibility of cheap electricity. It is to be expected that undertakers faced with a separation of the generating from the distributing side of their businesses will consider that the separate dual control thus introduced into the industry will be prejudicial to the efficient development of electric supply, and consequently will decide to dispose of their whole undertakings and will go out of business. We shall thus be left with a hopelessly over-centralised system of control with an attempt at decentralisation by means of the District Boards. These it is felt, from their very constitution, cannot prove anything but a weak form of municipal control.

It is earnestly to be hoped that these fears will not be justified, but that they appear well founded can hardly be denied.

BUSINESS NOTES.

German Electrical Securities Rise.—The *Economic Review* quotes the *Deut. Allg. Ztg.*, which reports that the rise in prices on the German Stock Exchange continued throughout October. From the list of those showing marked advances we select the following well-known electrical ones :—

	Oct. 1st.	Oct. 15th.	Oct. 31st.
A.E.G.	215	220	234
Schuckert	138	148	153
Siemens and Halske ...	180	192	225

Electrical Supplies in South Africa.—The *S. African Mining and Engineering Journal* for October 25th states :—"Ceiling roses, lampholders, and switches are getting very scarce indeed. Until the end of the war these were procurable from Japan, but they are unobtainable now. About four or five months ago ceiling roses were selling at from 4s. 6d. to 5s. a dozen ; now they can scarcely be got in town, except in retail quantities, and fetch 10s. 6d. a dozen. Lampholders, which went down from 15s. to 10s. 6d., are now up again to 12s. Switches came down from 36s. to about 21s., and are now ruling at about 24s. Indeed, the tendency of prices all round is to firm up."

Lead.—Messrs. James Forster & Co., in their report dated November 29th, say :—"We look for considerable difficulty in meeting actual consumptive demands for a long time to come, and a pronounced scarcity in the early part of next year is not at all improbable."

Japanese Imports of Machinery.—According to the *Osaka Mainichi*, orders from Japan for British or American machinery are very large at present. The demand is said to be concentrated on machinery pertaining to electricity, electric light and electric trams, steam boilers and spinning machinery. As regards the increase in the demand for electrical machinery, it is due to the development of communications and industry and also to the large increase in the price of coal. On the other hand, many capitalists who intended to import machinery for the enlargement of their business during the war, but hesitated on account of the enormous rise in the price of iron, have now made up their mind to import, as they have realised that prices will not decrease for some time to come, in view of the present labour and other difficulties prevailing in Europe. This attitude on their part has naturally increased the orders for foreign machinery, which have already amounted to large figures.—*Board of Trade Journal.*

Limitation of Profits in Industry.—The following resolution was unanimously passed at a meeting of the Executive Committee of the Federation of British Industries on November 26th :—

The Federation of British Industries emphatically protests against the proposed limitation of profits in the coal mining industry to a fixed sum per ton, as being unsound in principle and setting up a precedent, which if followed cannot fail to be destructive to the financial stability of the industries in this country, and to limit the initiative and enterprise of manufacturers.

The Imports and Exports Regulation Bill.—The *Board of Trade Journal* for November 27th contains a full article explanatory of this Bill, of which we gave a summary in our last issue.

C.A.V. "Notes."—We have received from Messrs. C. A. Vandervell & Co., Ltd., Acton, W., a neat telephone number register, with note pad, &c., for desk use, which will fill a want that we have often felt of late.

New Railway Rates.—*The Times* says that the revised schedule of railway goods rates will be considered by the Government next week. The statutory notice of 14 days will immediately follow their approval, and it is confidently hoped that they will come into operation on January 1st.

It is anticipated that the report of the Railway Rates Advisory Committee will recommend an increase of about 50 per cent. on the existing rates.

Cable and Telephone Manufacturing at Woolwich Arsenal.—In a report on the Premier's visit to Woolwich in connection with future activities at the Arsenal, a daily paper credits Mr. Mills, joint secretary of the All-Grades Committee, with saying that the Premier was shown the motor repair shop working to its fullest capacity, and was told that other shops could also be turned into beehives of industry. Mr. Mills said that a definite order for telephone work was coming to Woolwich, and a new industry—cable construction—was also to come there. All the machinery for it had been definitely ordered at the request of the Premier.

The A.E.G. and Vorarlberg.—The Berne correspondent of *The Times Trade Supplement* says :—"The action of Germany, who is undoubtedly doing all that is possible to gain commercial control of Vorarlberg, may cause State Councillor Calonder to announce shortly, in reply to a Parliamentary interpellation, that Switzerland is compelled to modify her attitude slightly. It seems certain that the Deutsche Bank and the Allgemeine Elektricitäts Gesellshaft have been working together in order to obtain complete control of all the water, and hence all the electric power in Vorarlberg, offering to agree to any terms demanded. Furthermore, while Germany can sell food in Vorarlberg at a profit, Switzerland loses heavily owing to the rates of exchange."

Patents and Inventions.—A pamphlet has just been issued by the Imperial Institute of Patentees, 6, Holborn Viaduct, London, E.C. 1, setting forth the objects of the Institute and indicating the assistance rendered to members. The pamphlet can be obtained post free on application to Mr. Godfrey Cheesman, organising secretary. The Institute is endeavouring to secure drastic amendments in the "Patents and Designs Bill" during the present session.

Dutch Glow Lamps.—It is announced that the directors of the N. V. Philips' Gloeilampen Fabrieken, as a result of the experience gained in the manufacture of their own lamp bulbs, have resolved to undertake the production of other semi-finished products, so as to render the company independent of third parties. The production of cardboard boxes has recently begun, and an extension of the works is now in progress for the manufacture of other articles hitherto purchased in the trade.

German Capital Increases.—The directors of Voigt and Haeffner A.G., of Frankfort-on-Main, propose to increase the share capital from 5,000,000 marks (pre-war, £250,000) to 10,000,000 marks, by the issue of new shares at the price of 112 per cent. In addition, the Elektrizitats A.G. von Hermann Poege, of Chemnitz, intends to double the present capital by raising it to 12,000,000 marks (£600,000), and to offer the new shares at 120 per cent. ; whilst a fresh issue is in contemplation by Brown, Boveri & Co., of Mannheim.

The Athens Exhibition.—The Exhibition of British Industries at Athens closed its doors on Sunday, November 23rd. We learn from information that is to hand that the Exhibition was extremely successful, surpassing the most optimistic anticipations. The attendance appears to have increased daily the longer the Exhibition remained open. A member of the staff of the Federation of British Industries, who recently returned from Athens, states that on occasions it was difficult to walk round the various sections. Full details of the business done have not yet been received, but most of the exhibits were sold outright almost immediately after the Exhibition was opened. In many instances the sales transacted by the exhibitors were so heavy that further orders were refused, as with the best will in the world it would not be possible for firms in this country to divert their whole output to the Near East, in view of the home demands and the insistant call of other countries. The King paid many visits to the Exhibition, and his interest has been reflected through all classes of the Greek commercial community.

The Greek community in general extended constant hospitality to the exhibitors and the officials of the F.B.I. The effect of the atmosphere created by the Exhibition will be of inestimable advantage to British trade interests in the future, and will be felt for a long time to come. Mr. Guy Locock, an assistant director of the F.B.I., on his return from Athens, met in Paris M. Venizelos, who expressed himself more than satisfied with the enterprise and energy displayed by the British manufacturers in organising an Exhibition of such scale and magnitude in spite of all the difficulties of shipping and the uncertain political conditions.

About 500 firms exhibited, and the value of the exhibits was over £500,000. Most of these exhibits will remain permanently in Greece, as they were bought outright. It is estimated that 100,000 people visited the Exhibition between October 14th and November 16th. The week's extension was arranged owing to the success that was achieved. The business community of Serbia, Rumania, Constantinople, Smyrna, and other Near Eastern and Balkan centres, attended in large numbers.

Book Notices.—*Electrical Engineering.* By H. H. Simmons, M.I.E.E. Revised by A. H. Avery, A.M.I.E.E. London : Cassell & Co., Ltd. In 14 fortnightly parts, price 10d. each net.—This useful work, originally published in 1910, is now being re-issued in parts, brought up to date and extended. It covers practically the whole range of electrical science, and while not of the "popular" style, is admirably suited for the use of the reader who is not well versed in electrical matters, the treatment being simple and non-mathematical. More attention is given in this book to electrochemical phenomena and electrodeposition than is usual in such works, but electromagnetic theory and apparatus, lighting, switchgear, traction, telegraphy and telephony receive a fair proportion of space. The illustrations are generally clear and well chosen, and as giving a comprehensive view of electrical engineering, the book fills a useful place in technical literature.

"Iron and Steel Works for 1920-21." Pp. 140. "Foundry (Iron, Steel, Brass, &c.) for 1920-21." Pp. 128. (Foster's Pocket Reference Books). F. Foster, 98, College Road, Whalley Range, Manchester. Price 2s. net (2s. 2d. post free).

"Industrial Peace : Capital, Labour, and Consumer ; a Basis of Co-operation." By T. B. Johnston. Bristol : J. W. Arrowsmith, Ltd. Price 6d. net.

New Motor-Car Company.—Under the title of Harper Bean, Ltd., a new company, including a number of well-known firms, has been formed, with a capital of £6,000,000, to apply mass production to automobiles. It is intended in two years' time to turn out 2,000 cars a week.

Japanese Trade with India.—In reply to a Parliamentary question last week, it was stated that the value of Japanese goods imported into India for the last financial year before the war, and for the last available completed 12 months, were :—£3,186,782, for the year ended March 31st, 1914 ; and £22,348,506, for the year ended March 31st, 1919.

Liquidations and Dissolutions.—Rhymney Valley and General Electric Supply Co., Ltd.—Winding up voluntarily. Liquidator, Mr. C. Carpenter.

Tilling, Stevens, Ltd.—Meeting of creditors at 1, Basinghall Street, E.C., December 9th (purely formal).

Macintosh Cable Co., Ltd.—A meeting is called for December 30th, at 6, Oxford Street, Manchester, to hear an account of the winding up from the liquidator, Mr. A. R. Handley.

Shire Arc Welding Co., electric welders, 3, Pease Hill Rise, Nottingham.—Messrs. J. Horton, J. Osbaldiston, and G. H. McMillen have dissolved partnership. Debts will be attended to by Messrs. J. Horton and G. H. McMillen, who will continue the business under the same style.

Nitrogen Products and Carbide Co., Ltd.—Winding up voluntarily for the purpose of amalgamation with the Alby United Carbide Factories, Ltd. Liquidator, Mr. H. A. McMahon, Winchester House, E.C. Meeting of creditors, December 15th.

Taylor & Scarths, electrical and mechanical engineers, Bridge Works, Fountain Street, Morley, York,—Mr. H. G. Scarth and Mr. M. R. Scarth have dissolved partnership. Mr. H. G. Scarth will attend to debts, and continue the business under the style of H. G. Scarth, electrical engineer, &c., at the same address.

F. A. Jennings, Ltd., Reno Works, Wealdstone, Middlesex, electrical and general engineers.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors of the above was held on Saturday, November 29th, at the offices of Messrs. Tingle, Comber & Co, chartered accountants, 110, Cannon Street, E.C. The shareholders of the company had previously passed resolutions for voluntary liquidation, and had appointed Mr. Tingle to act as liquidator. The company was registered in September, 1917, with a nominal capital of £3,000, divided into shares of the face value of £1 each. Subsequently, the capital was increased to £4,500, while in January of the present year it was still further increased to £7,500. No statement of affairs was submitted, the liquidator saying that he had not had time in which to prepare an accurate statement of the position. He added that he knew nothing about the company, and that a Receiver had been appointed to act on behalf of the debenture-holders. Mr. E. H. Hawkins said that in October and November of the present year, the company issued debentures to the extent of £9,500, and he asked whether they were issued for cash. The liquidator replied that he was unable to say what was the consideration for the issue of the debentures in question. A petition had been presented for the compulsory winding-up of the company. A creditor asked if it was anticipated that the assets would more than cover the debentures, and the liquidator replied in the affirmative. He added that there were debentures to the extent of £19,500. He could not say what the estimated value of the assets was, neither could he give the book values. The Receiver for the debenture-holders was not present at the meeting. After a short discussion a resolution was passed in favour of an application being made to the Court for the appointment of Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., as the liquidator of the company, with a Committee of Inspection, consisting of the representatives of the five principal creditors. It was also decided that the Court should be asked to make a supervision order on the petition for compulsory liquidation which had been presented by Messrs. Brunton's, Ltd.

Labour and Capital.—The *Manchester Guardian* reports that Sir John Paish, lecturing in the Memorial Hall, Manchester, on Wednesday, last week, forecasted revolutionary changes in the relations between Capital and Labour. He looked forward to the time when the working people would be their own masters, and when capital would be hired by labour, and not labour by capital. Already, in some measure, experiments had been made in that direction. Given a high standard of education, of discipline, and of character amongst the workers, with the desire not to gain the last shilling, but to be of service to their fellow-men, he had no doubt that these experiments would be a great success. Obviously the present high wages and costs would stimulate the introduction of machinery and more effective methods of production. In the next two years the cost of living would fall, and if wages were maintained, as they could be, the high level of wages would be real, and would buy a much larger quantity of goods than in the past. This meant that the working man, in many instances, would have a margin, which would give him the opportunity of subscribing very large sums in the aggregate to the capital fund. As working men became able to give security for capital, so, in proportion, would they be able to get capital at a low rate of interest. It was for them to decide whether they would hire capital and take the risk, and any profit that might accrue, or continue upon an agreed rate of wages. Personally, he would prefer to take the risk, and he thought the working people of the world would prefer to do so to. That was the way of progress. In the past, wages had been the first charge on industry, but in the future, capital would be the first charge. If the working people hired capital, the interest must be paid before the wages, otherwise they would not be able to get capital. That was assuming, of course, that workmen would be the owners of the mills in which they worked. Even if the mills were nationalised, a heavy rent would be charged by the State to meet the interest on the purchase money. But if the working people were to do all this successfully, they must make an alliance with the professional classes, with men who were capable of direction, men who knew how to manage. At present the alliance was between capital and the professional classes. It seemed to him inevitable that the workers would gradually gain control over the industries in which they were engaged. But unless their ideals were high and their character was high the idea would not work.

Industry and Housing.—Representatives of many important organisations formed a deputation to Dr. Addison, at the Ministry of Health. This deputation which was organised by the Joint Housing Committee of the Federation of British Industries and the National Alliance of Employers and Employed, pointed out the impossibility of public utility societies undertaking building under the terms of the Act of 1919.

Sir Algernon Firth (a Vice-President of the Federation of British Industries, and chairman of the Joint Housing Committee), introduced the deputation, and pointed out that the present rate of progress was not satisfactory, and that, despite announcements from time to time made in Parliament of the number of public utility societies who were content with the terms, few had proceeded with building. Many manufacturers were anxious to provide better living conditions for their employés by means of such societies, and there was evidence that groups of workpeople and co-operative societies would be willing to proceed if favourable terms were offered. At present, however, there was no security that they would even get their money back if they put it into such a society, much less was there hope of any return upon it. One of the chief arguments for public utility societies put forward in the Reports of the Joint Committee, and referred to with approval in Government circulars and pamphlets, was that the co-operative nature of these societies introduces a feeling of common interest between employers and their workpeople, and enables them to combine in the solution of the problem. If this object was to be achieved, it was essential that the tenants should be shareholders, and have a definite share in the management of a society. It was, however, impossible to secure co-operation if there were no dividends. The return on capital depended largely upon the rents which could be charged, and it was necessary that this point should be settled at once.

The Joint Committee suggested that if it were possible to ensure that private capital invested in public utility societies could be guaranteed some normal return—say, 4 per cent.—until such a time as rents were allowed to rise to their proper post-war economic level, it was probable that many would be willing to accept as a reasonable risk whatever might happen at the end of that period.

Sir Algernon pointed out that the Joint Committee put forward last March an alternative proposal, namely, that in view of the urgency of starting building all over the country at once, both to meet the housing shortage and to curtail unemployment, a block grant should be given for every working-class house built within one year.

Mr. Dawtry, of the Steam Engine Makers' Society, pointed out that the building of new houses would help considerably in solving the problem of unemployment, as there were many employers at the present time who were unable to employ additional workers owing to the lack of the requisite housing accommodation. He urged that everything should be done to assist working-class tenants to purchase their own houses.

Bankruptcy Proceedings.—*Re* Connolly Bros., Ltd., electrical engineers, &c., Blackley Vale Mills, Blackley, Manchester.—The following are the principal creditors under this failure :—

Unsecured.

Bolton & Sons, Thos.	£10,779	Johnson, Claphain & Morris	£61
Briggs, S. W.	21	Mosely & Sons, D.	1,297
Barlow, Ed., Ltd.	12	McConnel & Co.	74
Bellhouse, Ltd.	11	Midland Railway Co.	42
Clifton & Kersley Coal Co.	322	Maygrove & Co.	31
Connolly, H.	195	Major & Co.	11
Consterdine, T. G.	20	Neveson, A.	10
Evans & Sons, G.	54	O'Reilly, L.	1,248
Electrical Review, Ltd.	38	Priestley & Co.	38
Emmott & Co.	13	Pemberton, S. T.	37
Electrician, The	20	Paton & Son, A.	13
Electricity	11	Quicke & Co.	12
Electrical Times	10	Robinson & Co., J.	53
Frankenstein & Sons	514	Slater & Co.	134
Greenbaum & Co.	261	Somerville & Sons	19
Hecht, Ledio & Kuhn	2,070	Stanfield, J. R.	12
Hardman & Holden	16	Sykes & Harrison	11
Heap & Sons, W.	10	Vogelgesang, O.	15
Hull and Netherlands S.S. Co.	10	Whipp & Bourne	46
J. R. G. P. Selig Co.	141		

Trade Announcements.—Messrs. Francis Polden & Co., Ltd., of 56, Cannon Street, E.C. 4, have installed a private line exchange, and their telephone numbers are now :—"City 5538 and 5539."

Messrs. Brown Brothers having been demobilised, after three years' active service, are again about to undertake business as electrical engineers at 47, Hinstock Road, Plumstead Common, S.E.

For the convenience of clients in the North-Eastern District, the Electrical Apparatus Co., Ltd., have established branch offices and showrooms at Trinity Buildings, New Bridge Street, Newcastle-on-Tyne, under the personal management of Mr. P. H. Jackson, A.M.I.E.E., who until recently was in charge of the branch at Cardiff. A range of E.A.C. manufactures is kept there for inspection. Telephone No. : Central 3860 ; telegraphic address : "Elapratus," Newcastle.

In the last paragraph under "Trade Announcements" last week, the name of the firm was slightly incorrectly rendered. It should have been J. A. Kinnaird & Co., Ltd. The registered office of the company is 10, Blythswood Square, Glasgow ; there is a branch at Greenock. The managing directors are :—Mr. A. Henderson, M.I.E.E., late manager of the electrical department at Scott's Shipbuilding, &c., Co., of Greenock ; Mr. H. S. Kennedy, late manager of the Marine Department of Siemens Bros. Dynamo Works, Ltd. ; and Mr. J. A. Kinnaird, A.M.I.E.E., of Greenock. The company is a private one formed to undertake all kinds of electrical and general engineering and contracting business, and to take over the business of J. A. Kinnaird & Co., of Greenock, and to acquire other businesses.

Smuggling Magnetos.—Henri Vandegoor, motor-cycle dealer, of Shepherd's Bush, was fined £80 at Dover, on Monday, for smuggling three magnetos from Belgium under his clothing.—*The Times.*

French Electrical Companies.—La Société des Appareils Electriques Pax is the name of a new company which has recently been formed in Paris, with a capital of £24,000.

La Société Francaise Thomson-Houston, of Paris, is increasing its capital from 120,000,000 fr. to 200,000,000 fr.

Catalogues for Rhodesia.—Mr. F. L. Cater, A.M.I.E.E. (ex-captain R.A.S.C.), is going to join the staff of Messrs. Johnson and Fletcher, mechanical and electrical engineers, Bulawayo, and will be glad to receive catalogues of all descriptions, addressed to Box 224, Bulawayo, S. Rhodesia.

Catalogues and Lists.—The B.E. Co. (of London and Birmingham), Ltd., 57, Upper Thames Street, E.C.—Leaflet of "Beco" bowl fittings for semi-indirect lighting. List of electric heating stoves in preparation.

Messrs. Charles Fer & Co., 42, Newgate Street, London, E.C. 1.—List of small screws, and samples.

Messrs. Verdon, Cutts & Co., 87, Fargate, Sheffield.—Leaflet of fixed and portable sets for electric welding.

The Lancashire Dynamo and Motor Co., Ltd., Trafford Park, Manchester.—Leaflet relating to the "Lancashire" squirrel-cage induction motor and automatic centrifugal clutch.

Credenda Conduits Co., Ltd., Chester Street, Aston, Birmingham.—New season's list of electric fires. It contains, among other things, particulars of their new portable electric heater, of very low loading—600 watts—which is fitted with an adjustable copper reflector, enabling heat to be focused in any required direction. Also a booklet dealing with a new electric oven, for which special claims are made.

Housing Construction and Electricity Supply.—This is the title of a pamphlet issued by "E.D.A." last week, drawing attention to the importance of providing a supply of electricity before work is commenced on a building scheme, for lighting and power, and of taking advantage of electricity in designing the houses.

LIGHTING AND POWER NOTES.

Accrington.—New Sub-Station.—The E.C. has authorised the purchase of a site for a sub-station, at a cost of £1,100.

Aldershot.—Price Increase.—The following revised scale of charges has been adopted:—First 500 units per quarter, 4½d. per unit; 500 to 1,000, 4¼d.; 1,000 to 2,000, 4d.; 2,000 to 5,000, 3¾d.; 5,000 to 10,000, 3½d.; 10,000 to 15,000, 3d.; 15,000 to 20,000, 2¾d.; beyond, 2½d.

Batley.—Breakdown.—By a temporary breakdown at the electricity works last week, a considerable number of consumers had their supplies cut off. The breakdown occurred in the early morning, and it was well into the forenoon before the supply was restored.

Bexhill-on-Sea.—Loan.—The T.C. has applied for a loan of £4,000 for a feeder cable.

Birmingham.—Breakdown.—There was a general failure of electric light in the centre of the city on Friday afternoon. The failure was due to the breakdown of a generator at Water Street power station. Within an hour the light was restored.

Blackpool.—Loan.—The E.C. is to apply for sanction to a loan of £30,000 for electricity extensions.

Bramber and Buding.—Overhead Transmission.—The Sussex C.C. has sanctioned the use of overhead lines for E.L. purposes in the parish.

Continental.—Italy.—The Società Idroelettrica dell' Ancinale is about to build a new station on the River Corace, which will be linked up to the old one. The step is induced by the need to furnish a fuller supply of electricity to Catanzaro, and to the series of communes from Gimigliano to Guardavalla.

The Communal Council of Trento has under consideration the construction of a power station on the River Sarca to generate 10,000 kw.

The Commune of Treviso has decided to build a central station on the River Sile, between Treviso and Casier, where 1,900 h.p. will be obtained from a fall of 4·80 metres. The estimated cost is put at 2,535,000 lire, and the undertaking is expected to be completed within five years.

Sweden.—The Swedish Waterfall Board is applying to the Swedish Parliament for a grant of 23,000,000 kronor (about £1,280,000), for the completion of the hydro-electric stations at Harsprangèt, Motala, and Alvkarleo.

Dartmoor.—Water Power.—The Devon Hydro-Electric and Development Co. has been absorbed by the Wilson Syndicate, a combination of British interests controlling, it is said, capital exceeding £6,000,000. The Hydro-Electric Co. was formed for the purpose of promoting a Bill in Parliament to enable it to utilise the water power of Dartmoor for the generation of electricity and for developing that electrical power for the service of existing communities in Devonshire, and for stimulating industries which could be assisted by cheap power. The new syndicate will take up that task at the point to which the company has carried it; the syndicate is able to utilise waste gases of another industry to supplement the water power, and supply more than double the power at possibly a lower cost. The main purpose of the Wilson Syndicate is the establishment of copper refining works.

Glasgow.—New Sub-Stations.—Negotiations are proceeding with the sewage department for obtaining land at Dalmuir for a proposed power sub-station. Ground for a similar purpose has been acquired at Parkhead.

The purchase is recommended of 1,266 yards of land in Govanhill for a new sub-station.

Grimsby.—Discount.—A discount of 2½ per cent. is to be allowed on all accounts for electricity if the accounts are settled within 28 days of the end of the quarter. The recommendation met with considerable opposition. The Council also decided that a minimum charge of 7s. 6d. per quarter for the summer quarters, and 13s. 4d. for the winter quarters should be made.

Hebden Bridge.—Price Increase.—As from January 1st next, the charges for electricity for lighting purposes are to be increased by ½d., making the new price 7d. per unit, and for power purposes by 10 per cent., making the new price 3d. per unit, with an addition of 20 per cent. on the account.

Bulk Supply.—The Council is to make inquiries from the Halifax Corporation with a view to an agreement being entered into for supply of additional energy in bulk. The past month's output shows an increase approximating 20 per cent.

Jedburgh.—Proposed Price Increase.—The E.S. Corporation has applied to the B. of T. for an order to increase the charge to consumers per quarter from 10s. up to 20 units, and 6d. beyond, to 16s. 8d. and 10d.

Ilford.—Price Increase.—The price of electricity has been increased as from the quarter ending December:—Flat rate, from 7d. to 8d. per unit; maximum demand, from 8d. and 5d. to 8d. and 6d.; slot meters, from 7½d. to 8d.

Llandudno.—Bulk Supply.—The U.D.C. is considering the offer of the North Wales P. and T. Co. to supply electricity in bulk to the Council.

London.—Islington.—The B.C. is to spend £22,826 on extensions of plant at the electricity works.

Millom.—E.L. Scheme.—The U.D.C. has referred to the Gas and Water Committee a proposal to obtain a supply of electricity from the Barrow-in-Furness Electricity Works. The engineer of the latter (Mr. Burnett) advised a canvass of the district, and suggested the following charges:—Lighting, 5d. to 8d. per unit; power, 1½d. to 3d.; heating and cooking, 1½d. to 3d.

Northumberland.—Mine Electrification.—Mr. R. J. Weeks, managing director of the Bedlington Coal Co., has announced that the company is to do away with steam boilers, and to install electric power throughout the pits. The collieries affected are the Bedlington "Doctor," Bomarsund, West Sleekburn, and Sleekburn, one of the most important of the East Northumberland groups.

Plymouth.—Supply Restrictions.—Owing to the delay in the completion of the new plant now under construction and the shortage of fuel the E.C. is asking power users to stop their motors between 3·45 and 5 p.m., and business premises to reduce window and outside lighting, and to be as economical as possible in the consumption of energy.

Prices of Electricity.—The Ealing borough electrical engineer, Mr. Douglas Knight, reports that various municipal undertakings have increased their charges as follows:—Fourteen undertakings by 100 per cent. over pre-war charges; five at present charging 10d. per unit; and 15 9d. per unit. Also that applications are being made for powers to increase charges as follows:—Five undertakings from 8d. to 1s. per unit; two from 9d. to 1s.; one from 6d. to 10d.; five from 8d. to 10d.; one from 7d. to 9d., and one from 8d. to 9d. per unit. The net result of the accounts of the Ealing undertaking was a net loss for 1916 of £3,038; 1917, £1,529; 1919, £1,173; 1919, *nil*; or a total net loss of £5,745 for four years.

Singapore.—New Power Plant.—According to a report of the American Consul-General at Singapore, Straits Settlements, the Singapore Municipality is considering the construction of a new power station, which will supplement the existing plant. During the period of the war it was practically impossible to secure materials necessary for extending the electrical service, and applications for such service were refused, but now there will probably be a rapid development in this direction.

Stratford-on-Avon.—Price Increase.—The Electricity Co. has received from the B. of T. sanction to advance the price of electricity to 9d. per unit, subject to a revision after June 30th next.

Stalybridge.—Supply Restriction.—The mills and works in Stalybridge, Hyde, Mossley, and Dukinfield, which are run by electricity, owing to the heavy load on the plant at the generating station, will either have to alter their working hours or reduce the consumption until such time as the Joint Tramways and Electricity Board can meet the demands made for energy. Last week the generating station Committee met the large consumers, mostly representing the cotton trade, and also the representatives of the Trade Unions, and it is expected that arrangements will be made whereby some portions of the mills and works will commence at 6 a.m., and stop during the hours when the load is greatest. The Board must go forward with the new station at Hartshead, because if it had the new plant that was ordered, every extra kilowatt it would produce is already spoken for.

Stoke-on-Trent.—Extensions.—The E.C. has considered a report from the engineer upon the means for dispensing with the steam plant at the Burslem sub-works and upon the necessary cable and plant to give further supply to the northern district. The Committee is to apply to the M. of H. for sanction to borrow £26,000, the estimated cost of mains and buildings to double the capacity of the mains and to double the power taken to the northern district, and to increase the available conversion plant from 1,200 to 1,800 kw. in the Burslem sub-works. The amount is made up as follows:—Six-core 0·1-in. main power house to Burslem, £14,500: E.H.T. switchgear and buildings for same, £3,200; rotary converter, switchgear, and cable for same, £8,300. The estimated net saving is £1,160 per annum.

Loans.—The Committee is also to apply to the M. of H. for sanction to borrow £4,000, the estimated cost of switchgear extensions at Stoke sub-works, viz.—Two E.H.T. circuit-breakers and three L.T. switch panels, together with switch room to house same.

Application is to be made to the M. of H. for sanction to borrow £25,813, representing excess of capital expenditure on the electricity undertaking over loans sanctioned up to September 30th last.

Subject to the above being granted, and the sanction of the Finance Committee being first obtained before any portion is spent, the E.C. has been authorised to apply also for sanction to borrow £20,000 to cover prospective expenditure on mains and services, in order to obviate the necessity for numerous applications for small loans.

Warrington.—Extensions.—Extensions involving an estimated cost of £300,000, are contemplated. The present works are unable to handle the big demands that are made. It is understood that the new Committee will shortly bring before the Council a scheme of extensions which, if adopted, will come into operation in about 18 months' time, and enable the station to supply all demands.

TRAMWAY AND RAILWAY NOTES.

Bradford.—New Cars.—Another order has been placed for 62 sets of motors, and 85 trucks.

Burnley.—Accident.—As the result of a tramway-car overturning on the 28th ult., six passengers were injured.

Chile.—Railway Electrification.—The Government has published a law voting 25,000,000 pesos for the electrification of the first zone of the State Railways.

Continental.—Switzerland.—The Federal Council has not accepted an American offer of a credit of $300,000,000 for the establishment of electric traction on the whole of the Swiss railway network, on the condition that the supply of the material should be reserved to American firms. Instead, it has negotiated a loan of $100,000,000, reserving the right to carry out itself the installations, but pledging itself to procure some portion of the material required in the States.

Italy.—The building of an underground railway at Naples, the contract for which was secured by the French company, L'Omnium Lyonnais, before the war, will not be carried out by the contractors. Foreseeing that the original estimate of 35,000,000 lire would be exceeded by at least two-thirds as a result of enhanced cost of all materials and labour, it asked of the Italian Government indemnify to the like extent. This being declined, the French company has relinquished the contract.

The Società Tramvie Vicentine has worked out the plans for the electrification of the whole of its lines in working and those under construction. The company's tramways carry both goods and passengers, and the estimated outlay is put at 30,000,000 lire. The network of the company is about 220 km. in extent.

Application has been made by the Società Brivschi to work its Borgo S. Donnino-Salsomaggiore main line by electric traction.

The high cost of petrol has drawn attention to the advantages of using electric vehicles in districts in Italy where electric power for accumulator charging is available, and where the gradient and surface of the roads is favourable. These conditions prevail in Milan and its neighbourhood, and a new company for the manufacture and operation of electric vehicles is being organised in connection with the existing accumulator works. The capital of the concern is to be 3,000,000 lire. Electric 'bus services, and a regular express lorry service between Milan and Bergamo, are being run, and a development is aimed at particularly in respect of the heaviest procurable types of commercial vehicles. The United States Trade Commissioner says that the accumulator company in question, viz., the Société Generale Italiana Accumulatori Elettrici is desirous of coming to an arrangement with a manufacturer of electric trucks.

Cork.—Electric Vehicles.—It is proposed to introduce electric vehicles for domestic scavenging and street cleansing in the city. The city engineer is to visit London and other centres where electric vehicles are at work to obtain first-hand information, and report further on the scheme.

Ealing.—The removal of the tramway standards from the centre of Uxbridge Road will cost £4,284.

Edinburgh.—Extensions.—A prov. order is being applied for by the Corporation to extend the tramway system. In addition to converting the present mechanical cable system to electric, the Corporation will build new tramways, including a Portobello and Leith double line, and a double line from the present terminus at Nether Liberton to Liberton village.

Glasgow.—Proposed Fare Increase.—The T.C. Sub-Committee on Tramways Finance has, by a majority of one vote, decided to recommend that the fares be increased, and, by two votes, that a ½d. be added to each of the fares, thus converting the present ½d. fare into a 1d. fare. The amendments sought for a postponement of the matter until the end of the financial year, and the retention of a ½d. fare, the stages for which would be adjusted later. The recommendations will come before the parent Committee and the T.C. for confirmation. Glasgow T.C. has not, so far, increased the fares, but the general manager estimates the deficit on the first quarter of the financial year at £19,435.

Halifax.—Fare Revision.—It is proposed to adopt a new scale of tramway fares, viz.:—1d. for the first mile and 1d. for each further mile or portion of a mile, and for children under 12 years half this rate.

Hetton-le-Hole (Durham).—Electric Vehicles.—Mr. J. C. Dawes, M. of H. inspector, held an inquiry, on November 26th, into the application by the U.D.C. for sanction to borrow £6,000 for the purchase of three electric vehicles for the removal of house refuse and the cost of garage accommodation, charging plant, &c. The estimated cost of doing the work under the proposed scheme was £2,885 per annum, including the repayment of loan, while the cost under the old method was estimated at £3,283 for 1920.

Ilford.—Lease.—The U.D.C. has renewed the lease of the Ilford Hill tramway track to the East Ham T.C. for another three years as from July last, at 6½d. per car-mile for the first year; 6¾d. for the second year; and 6¾d. for the third year.

London.—Tramway Extensions.—The City Corporation is to inform the L.C.C. that the Court could not give assent to the proposed tramway extensions from Charles Street to Blackfriars Bridge across Ludgate Circus, Gray's Inn Road to Farringdon Street, Aldgate Terminus to Aldgate Station, and Aldgate to Tower Hill. Westminster Council is also to oppose the proposed extensions.

Manchester.—During the year ended March 31st, 1919, the motor-omnibuses of the Corporation Tramway Department ran 218,292 miles, and carried 1,821,310 passengers. The receipts per mile were 11·637d., against 9·564d. in 1917-18, and the working expenses were 14·918d., compared with 13·424d. The Corporation proposes next year to purchase 20 omnibuses at £1,750 each, and to spend £50,000 on garages and works extensions.—*Tramway and Railway World.*

Reading.—Time Extension.—The Ministry of Transport has extended the time of the Reading Corporation Act, 1914, until July 31st, 1920, for the completion of the tramways.

Spen Valley.—Proposed Fare Increase.—The Yorkshire (Woollen District) Electric Tramways, Ltd., has applied for an order to increase the fares and charges for parcels, animals, goods, and minerals on the railways and tramways.

TELEGRAPH AND TELEPHONE NOTES.

Cable Delays.—The Eastern Telegraph Co. announces that owing to the accumulation of traffic caused by interruptions of main line cables, it cannot satisfactorily cope with the increasing number of messages handed in by the public. The public is again urged to reduce the number and limit the length of telegrams as much as possible.

Colombia.—The Council of Ministers has just approved terms of a contract for the installation of a wireless telegraph station in Puerto Velillo, or some other suitable point along the coast, to be of sufficient power to maintain communication day and night with the international station to be installed at Bogota by the Marconi Co. The company is also to install a station in one of the islands of the archipelago of St. Andres and Providencia. The City Government of Cartagena has approved the contract for the installation of a modern telephone system in the city. In July, direct telephone service was established between Bogota and the port of La Donada.

The Central and South American Cable Co. has signed a contract with the Colombian Government, covering a term of 21 years, providing for the establishing of a cable service between Colon and Cartagena, Colombia.

Norway.—A statistical report for 1917-18 has been published by the Norwegian Telegraph Administration. The number of telegrams sent in the year was 6,339,159, of which 1,389,910 were foreign. The number of telephone conversations was 9,639,002, of which 173,858 were with Sweden and Denmark. Corresponding figures for the previous year were 9,061,262 and 177,217. Net receipts for the year were Kr. 18,795,958; working expenses, Kr. 15,182,699; and capital expenditure, Kr. 5,558,949.—*Economic Review.*

Storm Damage.—One of the worst windstorms for many years swept over Canada on Saturday, and all telegraphic services are interrupted.

On Tuesday last a gale swept over most of England and the North of France. Telephone wires have suffered more than telegraph lines. South Wales and the West of England were cut off through the breakdown of the Bristol connections. The Paris-London line was cut, but the newly constructed Brussels line survived.

South America.—Bolivia.—Six new lines are to be added to the telegraph system; four are now under construction. A wireless telegraph station has been installed at Cobija to put the north-east in communication with other parts of the Republic and with offices in Brazil. The wireless service has been divided into three zones with central stations at Riberalta, Yiacha, and Yacuiba.

Telegraph Rates.—In a written reply to a question asked in Parliament, the P.M.G. stated that the rates for ordinary telegrams were not remunerative, and he saw no prospect of their being reduced. The increased rates for Press telegrams of 1s. per 60 words before 6 p.m. and 1s. per 80 words after 6 p.m., with 3d. for each additional copy, had been adopted and embodied in the Telegraph Act, 1915. These rates would come into effect on January 1st; their operation was postponed because it was thought undesirable to take any steps which might have restricted the dissemination of news during the period of the war. The amount by which the revenue from these rates would fall below that anticipated from the higher rates proposed by the Retrenchment Committee, but not adopted, was approximately £180,000 per annum.

The Eastern Telegraph Co. announces that, from December 1st, reductions in tariff for telegrams over its system to places in British Africa came into force.

United States.—A new policy for control and development of wireless communications was laid before Congress on October 15th, by Secretary Daniels. It provides for maintenance of both naval and private stations, with the latter under control of a national wireless commission, and proposes to open existing or new stations to general public correspondence at rates to be fixed by the Navy Department and Congress. General public trans-oceanic correspondence through naval stations would not be permitted, however, except during temporary suspension of private service. Private wireless stations would be licenced by the commission, and their corporate affairs, apparatus, operators and transmission rates would be under supervision of the commission, which would be composed of four members and a secretary appointed by the President, with representatives of the Navy, War, Commerce and Post Office Departments. The secretary would be an active line officer of the Navy. The commission would be authorised to assist Americans in establishing wireless facilities with foreign countries, and to represent the Government in international wireless conferences. It also would attend board meetings of private companies. Under the Bill, aliens or alien interests could not obtain licences from the commission, and all officers and directors of private wireless companies would have to be American citizens. A majority of stock of such companies also would have to be held by Americans. In presenting the Bill, Secretary Daniels struck out a provision in his previous tentative measure, providing for acquisition by the Navy of existing stations, or those under construction, and that giving the Navy Department exclusive control of all wireless operations in the future. Private wireless companies would not be permitted to affiliate with submarine, cable, or land telegraph or telephone systems without consent of the national commission, and would not be permitted to operate in the Philippines or the Panama Canal zone.—*T. and T. Age.*

Wireless Telephony.—In connection with the Airco air services between London, Paris, and the Hague, a wireless telephone installation is to be fitted to the headquarters of the Aircraft Transport and Travel Co. at Westminster. It will thus be possible to communicate with machines while in flight.

Wireless Time Signals.—An Admiralty Notice to Mariners, No. 1,993, cancelling the former Notice No. 1,264, published in the *London Gazette*, gives an up-to-date and complete list of all time signals issued by wireless stations throughout the world, and intended for use by ships at sea. The notice foreshadows an universal standardisation of signals, and a regularisation of the times at which stations transmit both time and weather bulletins.

Wireless Railway Signals.—Signals operated by wireless telegraphy are shortly to be tried by the French State railways. The apparatus, fixed to the ordinary signals, comes into operation as soon as the signal is placed at danger. If a train passes a signal thus set an alarm is rung in the engine cab. The decision to try these protective measures follows as a result of experiments that have been in progress for the last two years on the line between Paris and Naintenon. The cost of introducing the new system is estimated at 20 million francs, and the lines to be equipped include those in the Paris area and the main lines from le Havre, Dieppe, Cherbourg, Brest, and Bordeaux.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Sydney.—City Council. January 5th, 1920. Electric Lighting Department. Outdoor H.T. switchgear (specification 566); air-brake switches (specification 565). Electric Lighting Department, Town Hall.—*Tenders.*

January 14th, 1920. N.S.W. Railways and Tramways Department. 70 3-phase induction motors for terminal wheat elevator.*

January 19th, 1920. Sub-station equipment (except power transformers). Contract No. 558.*

Melbourne. — P.M.G.'s Department. January 20th, 1920. Automatic telephone switchboard at Collingwood. Schedule 1,583. (September 19th.)

Belfast. — December 22nd. Electricity Department. Steam, water and other pipework for the New Harbour power station. (November 28th.)

Belgium.—December 16th. The municipal authorities of St. Gilles, Brussels, are inviting tenders for the supply of a 1,000-H.P. generating set, comprising, engine and continuous-current dynamo. Tenders are to be sent to, and particulars obtained from, the Hotel Communal, St. Gilles, Brussels.

Bolton.—December 10th. Electricity Committee. E.H.T. switchgear for the Back-o'th'-Bank generating station. (November 21st.)

Bournemouth.—December 15th. Tramways Committee. 20 bogie electric tramcars. Mr. J. Bulfin, General Manager, Tramways Office, Lansdowne Crescent.

Dublin.—December 10th. 12 months' supply of electrical supplies. Mr. N. Proud, Secretary, Port and Docks Office, Westmoreland Street, Dublin.

Govan (Glasgow).—December 30th. Clyde Navigation Trustees. Electrically-driven de-watering pumps for Nos. 1, 2 and 3 Graving Docks, Govan. W. Bridges & Co., Engineers, 3, Salters Hall Court, London, E.C. 4.

London.—L.C.C. December 9th. Overhead electrical equipment, low-tension cable, and laying stoneware ducts, &c., in connection with the construction of the Lee and Eltham tramway. (November 14th.)

Londonderry.—December 13th. Electricity Department. Two 500-KW. rotary converters with transformers, E.H.T. cubicles with switchgear, L.T. D.C. panels, cables, &c. (November 21st.)

Manchester.—December 9th. Tramways Committee. (*a*) Electric tramcar bodies; (*b*) tramway rail bonds (copper). Mr. J. M. McElroy, General Manager.

South Africa.—Johannesburg.—January 8th. Municipal Council. Copper wire, cable insulators and steel poles (Contract No. 548). Specification from Town Clerk, Municipal Offices, Johannesburg.—*B. of T. Journal.*

Tipperary.—December 13th. B. of G. Electric generating plant, comprising: suction gas engine, suction gas-making plant, dynamo, &c. (See this issue.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

CLOSED.

Australia. — P.M.G.'s Department. Commonwealth. Supply of cable to the various states:—

Western Electric Co. (Aust.), Ltd.—£17,940.
Horrocks Roxburgh (Pty.), Ltd.—£1,867.
B.I. & Helsby Cables, Ltd.—£1,808.
W. T. Henley's Telegraph Works Co., Ltd.—£1,884.
Callender's Cable & Construction Co., Ltd.—£6,471.
Laurence & Hanson Electrical Co., Ltd.—£1,881.
N. Guthridge, Ltd.—£502.
Siemens Bros. Dynamo Works Co., Ltd.—£6,027.
—*Industrial Australian and Mining Standard.*

Sydney.—City Council. Recommended:—
Insulated wires and cables.—W. T. Henley's Telegraph Works Co., Ltd., £1,499.
Consumers' meters, £18,581.—British Westinghouse E. & M. Co., Ltd.
1,000 A.C. consumers' meters, £1,900.—Edison Swan Electric Co., Ltd.

Melbourne.—City Council. Accepted:—
1,900 yd. lead-covered A.C. cables, £1,122. — W. T. Henley's Telegraph Works Co., Ltd.
68,660 yd. lead-covered D.C. cables, £13,328.—B.I. & Helsby Cables, Ltd.

Perth (W.A.).—T.C. Gas and Electricity Department. Accepted:
Two 500-K.V.A., three-phase, 6,000/440/250-V., oil-insulated, self-cooling transformers, £1,924.—Unbehaun & Johnstone, Ltd. (for Johnson & Phillips). —*Tenders.*

Glasgow.—Tramways Committee. Certain contracts for departmental stores have been renewed for a further period of six months.

Tramways Committee :—
Economiser parts.—The Clay Cross Co., Ltd.
Special track work.—The United States Steel Products Co., Ltd.
Resistances.—British Westinghouse E.M. Co., Ltd. (amended offer).

Kettering.—U.D.C. Electricity Works :—

Tenders for a 1,150-KW. geared turbo D.C. generator, with condenser plant, were received from the following : British Thomson-Houston Co. ; English Electric Co. ; Daniel Adamson & Co., Ltd. ; and C. A. Parsons and Co., Ltd. The tender of Messrs. C. A. Parsons & Co., Ltd., at £18,000, was provisionally accepted, it being the lowest tender. Guaranteed steam consumption per KW.-hour, 12·8 lb.

London.— HACKNEY.—Electricity Committee. Recommended :—

Two 1,000-KW. La Coeur motor converters and starting gear, £11,500.—Bruce Peebles & Co., Ltd.

HAMMERSMITH.—Electricity Committee. Recommended :—

Steel girders in connection with the new boiler foundations.—Foster Construction Co., Ltd., £63.

Hopper and chute in connection with the powdered fuel plant :—

G. A. Harper & Co.	£151
Foster Constrn. Co., Ltd. (including fixing) (recom.)	**153**
Baldwins, Ltd.	165
Brown, Lennox & Co.	184

Valves for steam ranges, one 7-in. and two 12-in. valves :—

Shaw, Son & Greenhalgh (recom.)	**£199**
J. Hopkinson & Co.	210
Cockburns, Ltd.	219

One ¾-in. electric drilling machine, £37.—Consolidated Pneumatic Tool Co.

Isolating switchboards in connection with the stand-by supply to the Osram Robertson Lamp Works :—

Park Royal Eng. Works (recommended)	**£99**
Switchgear & Cowans	145
G.E. Co., Ltd.	168

L.T. section pillars :—

Siemens Bros. & Co., Ltd. (recommended)	**£47**

Transformers :—

	Three 250 KW.	Six 100 KW.	Eight 200 KW.	Four 250 KW.
	£	£	£	£
Brit. Elec. Transfmr. Co., Ltd. (recom.)	**328**	**1,056**	**2,336**	**1,392**
Johnson & Phillips, Ltd.	345	1,104	2,456	1,464
Ferranti, Ltd.	403	1,319	2,916	1,736
Brush Elec. Eng. Co., Ltd.	390	1,272	2,800	1,640

Switchgear :—

	12 100 amp. per panel.	12 250 amp. per panel.
Park Royal Eng. Works (recom.)	**£29**	**£30**
Edison Swan, Ltd.	31	32
Reyrolle & Co.	36	45
Switchgear & Cowans	36	45
Ferguson, Pailin, Ltd.	41	44
Electrical Apparatus Co.	46	50
New Switchgear & Construction Co.	59	60
Metropolitan-Vickers Co.	64	65
G.E. Co.	73	76
Siemens Bros. & Co.	85	99

1,000 yd., '25 E.H.T. ; 250 yd., '075 × '075 '15 E.H.T. twin ; 1,000 yd., '2 L.T. cable :—

Western Electric Co. (recom.)	**£1,520**
Johnson & Phillips, Ltd.	1,549
Pirelli Cable Co., Ltd.	1,554
Henley's Telegraph Works Co., Ltd.	1,554
Callender's Cable & Construction Co., Ltd.	1,571
W. T. Glover & Co., Ltd.	1,596
Union Cable Co., Ltd.	1,597
Siemens Bros. & Co., Ltd.	1,605
Enfield Ediswan Cable Co., Ltd.	1,612
B.I. & Helsby Cables, Ltd.	1,641
Macintosh Cable Co., Ltd.	1,660

Steam piping :—

		Extra for facing and recessing flanges.
Millwall Engineering Co.	£1,308	—
J. Spencer	1,250	£10
Foster Bros. & Co.	1,078	48
Alton & Co., Ltd. (recom.)	**1,050**	**28**
Babcock & Wilcox, Ltd.*	1,010*	20*
Stewart & Lloyds*	879*	22*

*Does not include erection.

Salford.—Tramways Committee :—

72 British steel pinion wheels, £85.—British Hele-Shaw Patent Clutch Co., Ltd.
24 British steel gear wheels, £223.—A. Wiseman, Ltd.
60 steel tires, £372.—Hadfields, Ltd.

Electricity Committee :—

Two 300-K.V.A., three-phase transformers, complete in sheet-iron tank, mounted on rollers, £958 ; one 500-K.V.A., three-phase do., £693.—Metropolitan-Vickers Electrical Co., Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted :—

Davenport Engineering Co., Ltd.—Two cooling towers, £9,576.
New Conveyor Co., Ltd.—Extension of conveyor and elevator plant at central power house, £9,718.

Walthamstow.—E.C. Recommended .—

One 3,800-KW. Ljungström turbo-alternator, with condensing plant and steel platform, £28,390.—Brush Electrical Engineering Co., Ltd.
E.H.T. switchgear, £718.—British Thomson-Houston Co., Ltd.

FORTHCOMING EVENTS.

Batti Wallahs' Society.—Friday, December 5th. At the Cannon Street Hotel. Smoking concert.

Junior Institution of Engineers.—Friday, December 5th. At 20, Victoria Street, S.W. 1. At 7.30 p.m. Paper on "Some Notes on E.H.T. Switchgear," by Mr. E. F. Hetherington.

(**North-Eastern Section**).—Tuesday, December 9th. At 7.15 p.m. At the Armstrong College, Newcastle. Paper on "Design and Construction of Polyphase Induction Motors," by Mr. S. H. Moore.

Technical Inspection Association.—Friday, December 5th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Paper on "Inspection and Testing of Materials," by Mr. R. D. Summerfield and Mr. H. J. Davey.

Salford Technical and Engineering Association.—Saturday, December 6th. At 3 p.m. Visit to the Grain Elevator, Manchester Ship Canal, No. 9 Dock. At 6 p.m. At the Royal Technical Institute. Annual general meeting.

Chief Technical Assistants' Association.—Saturday, December 6th. At 3 p.m. At Anderton's Hotel, Fleet Street, E.C. Discussion on "Improving the Thermal Efficiency of Generating Stations," to be opened by Mr. H. F. J. Thompson.

Institution of Mechanical Engineers (Graduates' Section).—Monday, December 8th. At Gt. George street, S.W. At 6 p.m. Paper on "Large Boiler Units," by Mr. R. J. Glinn.

Association of Engineers-in-Charge.—Wednesday, December 10th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Industrial Reconstruction," by Dr. H. S. Hele-Shaw.

Royal Society of Arts.—Wednesday, December 10th. At John Street, Adelphi, W.C. At 4.30 p.m. Trueman Wood lecture on "Some Possible Sources of Energy," by Sir Oliver Lodge, F.R.S.

Institution of Electrical Engineers.—Thursday, December 11th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Paper on "Scientific Works Management," by Mr. J. M. Scott-Maxwell.

(**Students' Section**).—Friday, December 5th. At the City and Guilds Technical College, Leonard Street, Finsbury, E.C. At 7 p.m. Paper on "Thermionic Magnifiers," by Mr. H. M. Barlow.

(**North-Eastern Centre**).—Monday, December 8th. At the Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Ordinary meeting.

(**North-Midland Centre**).—Tuesday, December 9th. At the Midland Hotel, Bradford. At 7 p.m. Discussion on "The Linking-up Report," to be opened by Mr. T. Roles.

(**Scottish Centre.**)—Tuesday, December 9th. At 207, Bath Street, Glasgow. At 7.30 p.m. Paper on "Scientific Works Management," by Mr. J. M. Scott-Maxwell.

Society of Technical Engineers (Woolwich Branch).—Friday, December 12th. At the Royal Oak Hotel, Woolwich. At 7 p.m. Paper on "The Proper Position of the Engineer in Political and Industrial Circles," by Mr. E. C. de Segundo.

NOTES.

Northampton Polytechnic Institute. — The annual prize distribution and students' conversazione will be held to-night (Friday), December 5th, at 7.30 o'clock. The Marquis of Northampton will distribute the prizes and certificates. The conversazione will be continued to-morrow night.

Inquiries. — Makers of plant and instruments for the repair and testing of magnetos are asked for, and of a square hall lantern, built on the "knock-down" principle.

Appointments Vacant.—Technical assistant, £110 + 20 per cent. + £90, for the Barrow-in-Furness Corporation Electricity Department ; assistant draughtsman, for the Hackney B.C. Electricity Department ; shift engineer, for the Rawtenstall Corporation Electricity Department ; assistant in the Electrical Engineering Department (£250 to £370), for the Sunderland Technical College ; senior lecturer and demonstrator in Electrical Engineering (£350), for the Armstrong College, Newcastle-on-Tyne ; shift engineer (£240), for the Wolverhampton Corporation Electrical Engineering Department ; assistant shift engineer (80s. 9d.), for the Bury Corporation Electricity Works ; installation engineer (£250), wireman, for the Walsall Borough Electric Supply Department ; second assistant to mains superintendent (£258), for the Edinburgh Corporation Electricity Supply Department ; telegraph foremen (£372), for the Government of the Gold Coast. (See our advertisement pages to-day.)

The Taxation of Road Vehicles.—The Ministry of Transport announces the formation of a Committee to consider and report to the Minister upon the question of taxation of, and regulations affecting, road vehicles. The chairman is Sir Henry Maybury, Director-General of Roads, Ministry of Transport.

Safety First.—At the Roads Transport Congress, Mr. H. E. Blain read a paper on the "Safety First" scheme, in the course of which he said that one firm had reduced its first-aid costs from £1,300 to £600, and another had reduced its accident payments by over £50,000 per annum. The number of accidents in connection with the London General Omnibus Co.'s operations had been reduced from 22 per 100,000 miles run in 1916 to 17 in 1917, and to 14 in 1918.

The New Award to Engineers.—Hackney B.C. Electricity Committee recommends that those men employed in and about the electricity undertaking who are now receiving 28s. 6d. per week as war wage, plus 12½ per cent. per week on total earnings, shall receive an advance of 5s. per week on war wage, and that the technical engineering staff who are now receiving 20 per cent. on salary, plus £90 per annum, shall also receive an equivalent advance—namely, £14 12s. 6d.—on the sum of £90 per annum.

Union Rates?—The following extract from *John Bull* throws an amusing light upon the principles and practice of the Electrical Trades Union:—"The Electrical Trades Union have removed from 76, Gray's Inn Road to larger premises, and thereby hangs a tale. The Union had their new place wired by some of their own members, who charged 3s. an hour for the work, simply because the Union had advised them not to go to a job for less; in fact, an offered job had been refused on that very score. But the Union flatly refused to pay the 3s. an hour, their own stipulated rate, so the men posted a notice on the door that they had a grievance. For that action they were dismissed from the Union, and, by way of getting level, they pulled out all the work they had done. It is an instructive story of Trade Unionism, and more will probably be heard of it.

Fuel Economy.—There appears to be some uncertainty as to the exact effect of the removal of the restrictions on the use of electricity and gas. We understand the position is that the restrictions provided by the Household Fuel and Lighting Order are all removed, and the use of signs and outside lighting is permitted, but the Coal Controller reserves the right to call for returns if deemed necessary, and may also impose local or partial restrictions in cases where the supplier may be in difficulties in regard to fuel.

The National Gas Council states that the public must not expect a reduction in the charges for gas of 10d. per 1,000 cu. ft., and Mr. H. B. Renwick, chairman of the Provincial Electrical Supply Committee, says that any immediate reduction in the price of electricity is out of the question, the cost of coal being only one of many items, and the existing stocks of coal bought at high prices having to be used up first. No reduction in the price of gas or electricity will take place until the next quarter.

The Coal (Pit's Mouth) Prices Order and Direction, 1919, dated November 29th, provides that where coal is delivered to a gas or electricity undertaking the latter may, when paying therefor, give a certificate that a proportion of the said coal will be used for making gas or electricity for domestic or household purposes and shall in that case be entitled to deduct ten shillings per ton from the price in respect of such proportion.

"Truth" on Mansfield Meanness.—We cull the following from *Truth* for November 26th: "In my reference last week to the prosecution of the late chief clerk of the Electricity Department of the Mansfield Corporation I barely did justice to the meanness of the Corporation, not to mention its short-sightedness, in regard to the salary paid the holder of this responsible post. This position is now held by a widow lady. She has entire control of the office, is responsible for all books, meter readings, wages and stores, and has the handling of £40,000 a year. For this she receives the magnificent salary of £170 a year. It was she who discovered the defalcations of the late clerk, and her position was made a permanent one in July, but when she applied last week for an increase of salary the application was refused. What have the Labour representatives on the Council to say about this sweating of their officials?"

Barrow Electricity Staff.—The Borough Engineer reported that it would be necessary to have increases of staff at the Corporation electricity works, and he also suggested that as it might be some time before a fixed scale of salaries was agreed upon, the following increases should be granted as a temporary measure to the members of the technical staff from January 1st next, and that the fixing of a scale of salaries for the various positions should be deferred, and the payment of the award W. A. 9281 or any variation which might be made by the Ministry of Labour should be sanctioned, namely:—

	Present Salary.	Proposed Salary.
Works Department.		
Works Superintendent	£210	£250
Assistant Works Superintendent or Senior Charge Engineer	£130	£150
Constructional Assistant	£117	£150
Charge Engineers (three)	£104	£130
Junior Charge Engineer (one)	£91	£120
Mains Department.		
Mains Superintendent	£210	£250
Assistant Mains Superintendent	£130	£150
Meter Tester	£115	£145
Consumers' Department.		
Consumers' Engineer	£183	£215

The electrical engineer also reported that to keep up with the work which is now having to be dealt with, and to reduce the amount of overtime which is being worked by some members of the staff, it is necessary that two additional technical assistants should be appointed, one in the mains department and one in the consumers' department, and suggested that the commencing salary in each of these cases should be £110 per annum, plus 20 per cent., plus £90.

It was resolved that the report and suggestions of the electrical engineer be approved, and be referred to the chairman of standing committees sub-committee for consideration and report. The engineer further reported on the difficulty of obtaining and retaining skilled men, due to the difficulty of getting house accommodation in the borough except by purchase, and it was decided that the town clerk should report on whether the committee could make any advance to the men in its service who wished to purchase under the Small Dwellings Acquisition Act.

Code Telegraphic Addresses.—The decision regarding payment for registration of code addresses in America, which formed the subject of an article on page 677 of our issue of November 28th last, has been altered in so far that reversible registrations are cut out entirely and will not be registered. The respective correspondents in either country will have to arrange, if possible, to record the same local addresses in the States at an annual charge of $2.50 p.a. and in this country free with the telegraph companies or with the General Post Office at £1 1s. p.a. The position in Canada is still being considered.

Royal Engineers Volunteers.—The London Army Troops Companies have ceased to exist, as under War Office instructions all non-commissioned officers and men were discharged on September 27th. The officers, with the exception of the commanding officer, relinquished their commissions on October 17th. The C.O. is now the sole official representative of the corps. It is expected that there will be a balance of the funds available for charitable purposes.

Society of Technical Engineers.—On Tuesday evening a mass meeting of the South-Eastern District was held at the Central Hall, Westminster, and was well attended; Dr. J. F. Crowley presided, and Mr. C. H. Wordingham, C.B.E., gave an address. He pointed out that the Institution of Electrical Engineers had recognised the Electrical Power Engineers' Association as the protective association for power-station engineers, but many of its members did not come under that heading; the Institution could not approach the Society of Technical Engineers, because the latter was not mainly an electrical body, and he was therefore speaking purely in his private capacity. There was nowadays a strong tendency towards the association of those with common interests, and the main object of that Association was to enable force to be employed; the use of force was essentially regrettable, but unfortunately it was often indispensable. Associations of employers and workmen were already in existence, and were represented on the Whitley Councils, but the technical men were left out of consideration, and the only way for them to compel recognition was by combination in large numbers. The great engineering institutions had other functions to perform, and this association was complementary to them; it would not in any way encroach upon the activities of the institutions. Whilst adhering strictly to the rôle of a protective association, they should endeavour to work hand in hand with the professional institutions; this would add to their prestige and influence, and the benefits would be mutual. Everyone eligible should be enrolled, including engineers of the highest standing; care should be taken to ensure that the members were drawn from the right sources—mere numbers without quality would result in weakness. No man was so well adapted for administrative posts as the engineer, and he looked forward to the time when engineers would take a much larger share in working out the fortunes of the country; in the future this society would play a great part in the national organisation.

The Chairman drew attention to the value of Mr. Wordingham's recognition and approval, and pointed out that there was a tendency towards the nationalisation or control of industry; in private employ it was possible to rise to the highest posts, but under the State or municipality the engineer became subordinate to the politician and the ballot-box, and only numbers could avail to exert political pressure. The constitution of the society was now complete and ready for submission to the members.

Mr. H. J. Ping, chairman of the N.E. Section, moved a vote of thanks to Mr. Wordingham, and Mr. C. T. Allan, chairman of the Cardiff Section, seconded; Mr. Wordingham briefly responded, and afterwards the Chairman invited questions, which with the answers occupied a considerable time.

Hackney Electric Rifle Club.—The annual concert and distribution of prizes in connection with the above club was held in the Hackney Town Hall on November 28th, when the chair was occupied by the Mayor of Hackney (Mr. Alfred Payne, J.P.). A very good musical programme had been arranged under the direction of Mr. Fred Heathman (chief clerk of the electricity department). Midway through the proceedings appropriate speeches were made by the Mayor and his supporters, and as a mark of respect to the six employés who had given their lives for their country in the war, the whole assemblage rose to pay silent homage to their memory. The prizes were then distributed by the Mayor to the successful members, the May Cup and championship being won by Mr. A. G. Hilling, and the Mayor's Cup by Mr. H. Pratchett. The John Bull Cup fell to Mr. C. Turner, the Robinson Cup to Mr. R. W. Rolfe, the Smith Trophy to Mr. A. G. Hilling, and the Bottomley Shield to Mr. E. Mathews. Mr. L. L. Robinson, borough electrical engineer, then presented to the hard-working and enthusiastic secretary, Mr E. Mathews, a handsome glass flower vase.

Electrically-welded Ships.—There was recently launched at Caen the first electrically-welded ship to be built in France. This vessel, which will serve as a floating workshop for the Société Soudure Electrique Française, is 20 m. long, 4 m. beam, and 2·3 m. draught. It will be electrically equipped, and be driven by a 35-H.P. motor.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The inaugural meeting of Liverpool Sub-Centre was held at the University on November 21st. Mr. J. A. Robertson, chairman of the N.-W. Centre, was in the chair, and was supported by Prof. E. W. Marchant, Mr. H. Dickinson, Dr. W. Cramp, Mr. B. Welbourn, Mr. A. G. Ellis, N.-W. Centre, hon. secretary, and Mr. A. L. Green, N.-W. Centre, assistant secretary. The meeting was attended by about 60 members and non-members of the I.E.E. Mr. Robertson made opening remarks on the desirability of forming a Sub-Centre in Liverpool, as had recently been done in Preston with considerable success. A resolution, proposed by Mr. Nesbitt and seconded by Mr. Dickinson, "That this meeting resolves to form a local Sub-Centre of the I.E.E. in Liverpool," was unanimously carried. A Provisional Committee consisting of 15 members, was elected to hold office until the end of the present session, consisting of the following:—Chairman: Prof. E. W. Marchant. Vice-chairman: Mr. H. Dickinson. Hon. Secretary: Mr. O. C. Waygood. Members: Colonel Bates, Messrs. Clothier, Hollingsworth, Lang, Nesbitt, Welbourn. Associate Members: Messrs. Bailes. Hamilton, Harrison, Hawkins, Macdonald, and Spencer.

A meeting was subsequently held of those members of the Provisional Committee who were present, with Dr. Marchant in the chair. It was decided that the meetings of the Liverpool Sub-Centres be held on Monday evenings at 6.30 p.m., and that the first meeting be held on Monday, January 19th, at which it was suggested that Dr. Marchant should give the address.

At a meeting of the North-Eastern Centre on November 24th, Mr. W. D. Owen gave a lecture on "Wireless Telegraphy in the Mercantile Marine."

The next Wireless Sectional meeting will be held at the Institution of Civil Engineers, at 6 p.m., on December 17th. (Light refreshments at 5.30 p.m.) Prof. G. W. O. Howe, D.Sc., will read a paper on "High-Frequency Resistance of Wires and Coils."

A meeting of the Western Centre was held at Bristol on Monday evening last. Mr. Arthur Ellis presided, and announced that the Council was considering a suggestion from the Western Centre of holding a summer meeting in the Western District. He urged the members to do their utmost to make the proposed meeting a success. Mr. W. A. Chamen (engineer and general manager, South Wales Power Co., Ltd.) gave an address on "The Financial Side of Electricity Supply," and his defence of the financial results obtained by power companies, as compared with municipalities, gave rise to a very keen and interesting discussion.

Illuminating Engineering Society.—At the first meeting of the session on November 25th, a report was presented by the Committee on Progress in Lamps and Lighting Appliances, which stated that the supply of metal-filament lamps was rapidly approaching the normal, and that the production of lamps in this country was approximately equal to the consumption, though makers had not been able to accumulate stocks. A certain number of glass bulbs had still to be imported, but in the near future the whole demand for glass and bulbs would be met by internal production. Adequate supplies of argon were now available. The supply of English globes for use with gas-filled lamps was entirely inadequate, and a number had to be imported. There was a scarcity of suitable fittings for use with gas-filled lamps of the smaller sizes now available for shop-window lighting, &c.

An exhibit of "Pointolite" lamps was demonstrated by Mr. P. Freedman, of the Ediswan Laboratory. These lamps are now made in sizes from 30 c.p. to 4,000 c.p., the latter being a new development. Since their introduction four years ago, various improvements have been made in their construction, and others are in prospect. Mr. H. T. Harrison showed a new form of illumination photometer.

On Tuesday last week, Mr. A. P. Trotter, president, gave an interesting address on the work of Lambert, who was born in 1728, and contributed very important work to the development of science, including the art of photometry; he was the author of the Lambert cosine law.

Royal Society.—A Royal Medal has been awarded to Mr. J. H. Jeans, F.R.S., for his researches in applied mathematics, and the Hughes medal to Dr. C. Chree, F.R.S., for his researches in terrestrial magnetism. On December 1st, Prof. Sir J. J. Thomson, O.M., was elected president.

At a meeting of the China Society, held at the School of Oriental Studies, on Monday, November 27th, Prof. Middleton Smith, of Hong-Kong, read a paper on "Industrial Changes in China." The Chinese Minister, who presided, hoped to see greater co-operation in the future between Great Britain and China.

Royal Institution of Great Britain.—The course of Christmas lectures for a juvenile audience will be delivered by Prof. W. H. Bragg, F.R.S., on "The World of Sound." The lectures will take place on December 30th and January 1st, 3rd, 6th, 8th and 10th, at 3 o'clock.

Societe des Ingenieurs Civils de France.—The inaugural meeting of the British Section of the Société took place last week; Mr. C. H. Wordingham presided, and Mr. T. J. Guéritte, president for the first session, delivered an address.

Edinburgh Electrical Society.—At the first regular meeting held on Wednesday, November 26th, office bearers for the current session were elected, and a constitution was approved. It was decided to adopt the designation "The Edinburgh Electrical Society," in place of "The Edinburgh Electric Club," under which name the preliminary notices were sent out. Mr. W. S. Johnson, 17, Comely Bank Street, Edinburgh, was appointed hon. secretary and treasurer, and over 100 members were enrolled. The next meeting of the society will be held on Wednesday, December 10th, in the Philosophical Institution, 4, Queen Street, Edinburgh, when a paper will be read by Mr. James Walker on "The Repair and Maintenance of A.C. and D.C. Machines," with lantern illustrations.

Aeroplanes and Hydro-Electrics.—The *Economic Review* quotes *Stockholms Dagblad* of November 9th, stating that the Water-Power Board wishes to institute an air-service in Lapland between Porjus and the dam in process of construction where the Suorvajaure joins the Lule River. There is no other means of communication between the two places, and it is estimated that an aerial service would effect a saving of Kr. 90,000. As the cost of the journey there and back every other day is estimated at Kr. 140,000 per annum, a request for a Government grant for the remaining Kr. 50,000 has been made.

OUR PERSONAL COLUMN.

The Editors invite electrital engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—A South African contemporary states that Mr. B. Sankey, M.I.E.E., electrical engineer to the Municipality of Port Elizabeth, has been appointed electrical engineer to the Johannesburg Municipality.

Mr. J. Townley, the deputy electrical engineer to the Barnsley Corporation (who is leaving that position to take a similar position under the Sunderland Corporation), has been presented with a leather travelling case as a mark of the esteem with which he has been held by his colleagues in the electricity department. Mrs. Townley was also made the recipient of a set of silver serviette rings. Major Barker, the borough electrical engineer, made the presentation at a recent smoking concert of the employés.

On November 25th, Mr. S. High, mains foreman of the Birmingham electric supply department, was the recipient of a gold watch, suitably inscribed, from his colleagues of the department, on his leaving to take up an appointment with the Manchester electric supply undertaking as assistant in the mains department. Mr. High had completed eight years' service. The presentation was made by Mr. W. E. Groves, mains engineer.

General.—The committee which recently heard evidence respecting the claims set up by those who had to do with the introduction and development of tanks for use in the late war, made no grant in the case of Col. R. E. Crompton and Mr. Le Gros. Their reference to the services of these gentlemen reads:—

> These claimants were employed for some six months as consulting engineers to the D.N.C. Committee at a substantial agreed remuneration. In the discharge of their duties they worked loyally and very hard, and no doubt supplied the committee with useful data and sound advice. But they did not, in the result, invent or discover the special features subsequently incorporated in the tanks, and we cannot consider their services as of such an exceptional or extraordinary character as could alone justify an award in addition to their agreed salaries.

Colonel Sir Rhys Williams has resigned the office of Parliamentary Secretary to the Ministry of Transport.

We regret to learn that Dr. C. R. C. Lyster has had to retire from his work in the X-ray laboratories of the Middlesex Hospital, as he is now incapacitated by the paralysing effects of frequent exposure to the rays. According to the daily Press he contracted X-ray dermatitis some years ago. It affected his hands, and repeated operations were performed, but though he lost first one finger and then another, he continued his research.

Major J. E. Dunning, D.S.O., and Mr. J. Pedriali, the general manager in Buenos Aires, have been appointed directors of the Anglo-Argentine Tramways Co., Ltd.

With reference to the note on p. 694 of our last issue reproduced from *Indian Engineering*, our contemporary corrects its statement by saying that Mr. F. E. Bull and Mr. J. W. Meares are to be joint chief engineers of the Hydro-Electric Survey mentioned.

The *Morning Post* says that Major (temporary Lieut.-Col.) S. C. Wace, R.M.A., Communications Division, Admiralty, has been appointed as head of the Wireless Telegraphy Board in succession to Capt. A. Slee, R.N.

Colonel W. A. Wadham, the Mayor, has been re-elected chairman of the Barrow Corporation Electricity Committee and Councillor A. Barrie vice-chairman.

According to the S.A. *Mining and Engineering Journal*, Mr. A. E. Simmonds, of Messrs. Belliss & Morcom, Ltd., Birmingham, has been on a visit to the Rand.

Hammersmith B.C. Electricity Committee has appointed Alderman Johnson chairman, and Councillor Bedford vice-chairman, for the ensuing year.

Alderman W. Bruce has resigned the chairmanship of the Sunderland Electricity Committee owing to continued ill-health, and Councillor R. J. Wilson, the vice-chairman, has been appointed chairman, with Councillor T. Speeding as vice-chairman.

Mr. H. G. W. Haslett, Chief London representative for Messrs. Shenton & Co., Ltd., and Mr. E. G. Kennicott Calder, South of England representative for the same, have

resigned their positions and have joined Messrs. Haslett, Calder, Saxby & Co., manufacturers' agents and electrical factors, 63, Queen Victoria Street, E.C. 4, the former as sales manager and the latter as sales engineer.

Obituary.—DR. JANGEAS.—A *Daily Chronicle* correspondent at Paris reported on Monday that a French doctor and X-ray specialist named Dr. Jangeas, assistant chief of the Radiographic Laboratory at the St. Antoine Hospital, had met with a fatal accident while carrying out radiographic experiments. Dr. Jangeas was preparing apparatus at the American hospital at Neuilly to radiograph several patients when, through some oversight on his part, he received a shock. He died almost immediately. He was 39 years of age.

MR. THOMAS FLETCHER.—We regret to have to announce the death, which occurred on November 26th, of Mr. Thomas Fletcher, a well-known figure in the telephone and telegraph world. Mr. Fletcher, who was born in London in 1849, commenced his business career with a London architect, but in 1868 he entered the engineering department of the United Kingdom Telegraph Co., with whom he stayed until 1870, when he entered the service of Henleys, the well-known telegraph contractors. In 1873 he accepted an offer made by Sir William Thomson (later Lord Kelvin) to assist in developing his siphon recorder for submarine cables at the Glasgow University, and he was also engaged on the testing of the Brazilian submarine cables being made at Hoopers', Millwall, to the specifications of Sir W. Thomson and Fleeming Jenkin. In 1874 he returned to Henleys' service, and spent considerable time on submarine cable laying expeditions. He was afterwards in the Post Office with Mr. W. H. Preese (later Sir W. Preece). With Mr. Preece's introduction he entered the service of the newly established Telephone Company in 1878 as engineer, and remained in that service through its many changes as the United Telephone Co. and later the National Telephone Co., until January, 1912, when he went over with the staff to the British Post Office, where he remained until his retirement in the spring of 1914. During his long connection with the telephone service his large experience and ability were of great value. At the interment in the City of London Cemetery on December 1st the body was followed by a number of his old colleagues and others, including Messrs. Aitken, Brien, Davies, France, Francis, Gall, Kingsbury, Kipping, and Poole.

CITY NOTES.

Auckland Electric Tramways Co., Ltd.

The total revenue for the year ended June, 1919, was £300,724. The traffic receipts were £292,503, a decrease of £2,061. After providing for all expenses chargeable to revenue, including £22,487 for debenture and other interest, the rental and percentage of profits payable to the Auckland City Council, amounting to £4,235, and setting aside £22,500 to the renewals and depreciation account, there is a surplus on the year's working of £35,304, plus £5,973 brought forward, making £41,277. The preference dividend to June 30th, 1919, requires £9,000, and an interim dividend on the ordinary shares for the December, 1918, half-year of 6d. per share, less tax, was paid in May, and amounted to £11,250. The Corporation having exercised its option to purchase, possession of the undertaking of the company ceased on July 1st, 1919, from which date the company ceased to be interested in the operation of the tramway undertaking. The whole of the purchase money is to be payable in debentures of the Corporation, the exact amount being subject to various adjustments. The chairman is now on his way to Auckland to complete the arrangements in connection with the sale of the undertaking and the handing over of the debentures of the Corporation to the company. Having regard to the foregoing circumstances the directors recommend that a further dividend be paid on the ordinary shares of 6d. per share, less income tax, for the half-year ended June, 1919, making a total dividend of 1s. per share for the year, which will require £11,250, and that £9,777 be carried forward. £7,872 first mortgage debenture stock was bought and cancelled, the average cost to the company being approximately 89½ per cent. The route mileage is 27.13. The passengers carried were 43,785,594, against 44,823,967; average receipts per passenger 1.60d., against 1.58d.; average expenditure per passenger, 1.19d., against 1.04d.; proportion of expenditure to receipts 74 per cent., against 66 per cent. Number of cars 166.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

Mr. J. H. Armstrong presided at the extraordinary general meeting held in Newcastle on November 24th. Resolutions were passed, with five dissentients, approving the creation of £3,500,000 additional capital, to be divided into 1,500,000 7 per cent. cumulative preference shares of £1 each, 1,000,000 5 per cent. preference shares of £1 each, and 1,000,000 ordinary shares of £1 each, making the present authorised share capital £6,500,000, divided into £1,500,000 7 per cent. cumulative preference shares, £2,500,000 5 per cent. preference shares, and £2,500,000 ordinary shares.

The CHAIRMAN said that a public utility company such as that was under statutory obligations to afford an efficient and reliable supply of electrical energy over a large area, and it could not stand still. It was of necessity progressive, and as the manufacture of turbines, electrical plant, buildings, and foundations required for extension took a considerable time to complete it was necessary for them to look some years ahead as to the probable load and so arrange contracts two or three years in advance to be sure that everything would be ready when it was wanted. During the war, and especially during 1917 and 1918, it was their duty to prepare for all war requirements, as well as for their ordinary business, and they were obliged to supply more and more electrical energy for munition purposes. To do that it was absolutely necessary for the company to enter into a large programme of development. The completion of that programme had been very much delayed by war conditions, and the cost had been much increased over the original estimates, due to the phenomenal rise in the cost of labour and material. On the other hand, the cost of this new plant would be much less than its value if they had had to start to it now. The capital now required was for commitments entered into for the most part in 1917 and 1918. To meet them the company would require large sums of money before the end of 1920 for balances due to contractors, and also to pay the bankers for advances made to meet instalments already paid to the contractors. It was, therefore, necessary in the interests of the company that the further capital should be raised as soon as possible. The issue they proposed of 7 per cent. cumulative preference shares would provide for the completion of the present programme. They would, when all the generating plant now contracted for was complete and running, have sufficient to meet the load which they confidently expected to have to deal with when the present disorganisation in business and in trade ceased, and when the big development which seemed likely took place. They had given much consideration as to how best the money could be raised. They had two main considerations: first, not to damage the interests of existing shareholders, and second to offer such terms for any new issue as would be acceptable both to the shareholders and to the public, in view of existing financial conditions. He had received a few criticisms from preference shareholders, in which they took the view that such an issue as the company proposed was unfair to themselves. The interests of the existing preference shareholders had been fully considered, and they came very definitely to the opinion that the course they proposed was not only not to their disadvantage, but certainly to their advantage. It must be remembered that the existing preference shares were not really preferred, but preferred ordinary shares; they had no prior capital rights over the ordinary shares. They received, it was true, a 5 per cent. preferred dividend; then they had to wait until the ordinary received 8 per cent. before they got any more. After that they had a first right to an additional 3 per cent., and thereafter they shared equally with the ordinary. The preference shareholders had, therefore, a direct interest in the reversion of the company, and stood to benefit from any additional prosperity that came to it. The important point for the preference shareholders was for them to consider whether the new money which was being spent on the company's development, and which would be provided by the new issue, was likely to earn more than the 7 per cent. dividend on the new shares, as, if so, both existing preference and ordinary shares would participate in the reversion and benefit thereby. There was no doubt that the new capital would earn its dividend, as they would agree when they considered the matter. He had mentioned at their last annual meeting that as against the munition load which they had lost on the cessation of hostilities, they had on their books applications for connections with the company's systems representing more than 65,000 H.P., which was an amount considerably in excess of the munition load lost. Only a small portion of that new business had so far been connected to their system; meanwhile, however, the applications for supplies had increased, and the figure now stood at 86,000 H.P. A saving of coal consumption was to be expected as the result of the new plant, and on the basis of the reduced output for the current year and the present coal cost there would be a saving during 1920 as compared with last year of at least £60,000, and by the time the whole plant was running a saving at the rate of £100,000 per annum. During the year 1920, in addition to those economies, there would be a reduction in the charge for bank interest in respect of the advances made. When, therefore, the 86,000 H.P. applied for—representing as it did over 20 per cent. of their connected H.P.—was connected to their system, and when trade had resumed more normal conditions, they would have a larger load than they had ever had before, but one with which their new plant would be fully capable of dealing. If, therefore, they took into consideration the profit upon that large increase of H.P. applied for, together with the savings and economies he had referred to, it must be clear that the profits earned would not only meet the dividend on the new preference shares, but would leave a considerable balance over and above available for building up reserves and the payment of dividend on existing preference and ordinary shares. As to the terms the company would have to offer for any new issue, they were definitely advised by their financial advisers that having regard to the present value of money and to the rates that capital could now secure, the company

could not offer less than 7 per cent. on a cumulative preference share, having priority rights both as regards capital and dividend. Their intention was to issue the whole of these new preference shares. The interests of both the preference and ordinary shareholders had been protected by the fact that it was intended to give them a preferential right in the allotment of the new issue. With regard to the proposal to increase the existing preference and ordinary capital by £1,000,000 each, that was suggested to make provision for future requirements. The directors considered it advisable to take advantage of the present opportunity to create these shares so that they might be available for future issues in the event of necessity arising. In concluding, he mentioned that they had been in negotiation with the North-Eastern Railway Co. regarding a supply of power in connection with the proposed scheme to electrify the main line between Newcastle and York. They would no doubt have noticed recently in the Press the decision of the directors to carry this electrification proposal through. Having regard to the fact that the Newcastle Electric Supply Co. had supplied all the current required by the railway company, both for the electrification of its local lines and, more recently, for its new mineral line between Shildon and the Tees, he felt satisfied that when the time arrived, arrangements for the supply of power by this company for this new venture would be completed, but how long it would be before that scheme would come into operation it was impossible to say.

Mr. Brand, financial director of the company, in seconding, said he had carefully considered the proposals from the point of view of the existing shareholders, and from the point of view of the interests of the company in the position in which they were in having to have new money. He thought the share proposed was an attractive one, and it was greatly to the interest of the existing shareholders that they were going to give them a preferential right, as was natural, in any subscription they cared to make.

German Companies.

The liquidators of the *Helios Elektrizitats A.G., of Cologne*, the winding up of which has now extended over a number of years, report a deficit of £419,000 for 1918-19, being the same as in the preceding year. The securities in portfolio are booked at the value of £69,000, as in 1917-18.

The Elektrotechnische Fabrik A.G., Schorch & Co., of Rheydt, after placing 57,000 marks (£2,850) to depreciation in 1918-19, as compared with 180,000 marks (£9,000) in the previous year, reports net profits of 513,000 (£25,650), as against 1,743,000 marks (£87,150). It is proposed to pay a dividend of 10 per cent., as contrasted with 20 per cent. in 1917-18. The less favourable results were specially due to the reduced efficiency of the workmen, and no improvement has taken place in this respect in the new financial year.

The accounts of *Brown, Boveri & Co., A.G., of Mannheim*, show gross profits for 1918-19 of 14,879,000 marks, as against 10,918,000 marks in the preceding year. After defraying working expenses, which rose from 6,263,000 marks in 1917-18 to 10,388,000 marks last year, meeting interest on loans, and setting aside 702,000 marks for depreciation, as compared with 1,243,000 marks in 1917-18, there remain net profits of 827,000, as compared with 1,780,000 marks in the previous year. It is proposed to pay a dividend of 9 per cent., as compared with 15 per cent. in 1917-18. The report states that owing to the transition from war to peace work the machine department, which had been subject to heavy demands, slackened down to almost nothing to do, but subsequently the construction and repair of locomotives were undertaken. On the other hand, the transformer and apparatus departments obtained an abundance of orders. As a consequence of the extraordinary expenses for wages and manufacturing, the company's funds were almost exhausted, and it would be necessary to raise additional working capital, and also make provision for extensions of the works.

Marconi's Wireless Telegraph Co., Ltd.

Mr. Godfrey C. Isaacs presided at the extraordinary general meeting on November 28th, at which the resolution increasing the capital was passed. In the course of his speech, he referred to the appointment of the new committee to report upon Imperial wireless matters. He understood that the committee would decide whether or not the stations would be erected for account of the State, whether private enterprise should be licensed to erect them for their own account, or, as a possible third alternative whether they should be erected by private enterprise conjointly with the State, with State control. He had already on a previous occasion informed them that they had applied to the Imperial Communications Committee for licences to erect and work these stations. They had also intimated their willingness to enter into an alternative arrangement under which they would erect them conjointly with the State, leaving to the State effective control. These proposals had been under consideration, and the appointment of a committee to advise what stations were required, was, he hoped, a step towards securing to the Empire a chain of wireless stations of the latest and best system comprising all the recent important improvements in wireless communication. Such a network of wireless stations connecting up the distant parts of the Empire, and so arranged as to communicate with all the other parts of the world which they could facilitate either through their own stations or through those with which they had priority of service, would furnish a much-felt need in all industrial centres and materially strengthen our hands in the world's competition for trade. This company alone possessed for the British Empire all the efficient commercial wireless systems, besides having the sole right of all new patents and improvements, so far as the Empire was concerned, in those systems even whether they originated from any of the important wireless companies in foreign countries, and also the benefit of any and every patent which might emanate from the General Electric Co., of America, in so far as it might relate to wireless telegraphy or telephony.

In his reply to questions, the chairman said he refused to believe that the Marconi Co. or the country was going to suffer because there had been a dispute with regard to the settlement of accounts as between a Government department and the company. So far as the company was concerned, he had told them on many occasions that there would have been no Petition of Right and there would have been no disagreement at all if an opportunity had been given to the company to come to an amicable settlement, even at a sacrifice. He did not think it would be possible to erect such stations as were required for an efficient service, a commercial service between this country and the Dominions beyond the seas, without having recourse to the very valuable patents of the Marconi Co., the great discoveries they had made in recent times, and to the very efficient system they were able to-day to offer. The only possible means of working stations without the Marconi Co. would be by adopting an obsolete system, very imperfect, and wholly inefficient for the conduct of a commercial service, and he, for one, refused to believe that the Government would ever attempt to do anything of the kind or that it would ever be recommended to them that they should do anything of the kind, or that the country would ever tolerate anything of the kind. He had no anxiety from that point of view.

International Light & Power Co., Ltd.—The net profit for the year ended June, 1919, was £28,939 plus £34,099 brought forward. After paying accrued preference dividends £33,904, and preference dividend for the year £12,757, £2,500 was put to reserve for contingencies and £13,877 is to be carried forward. £100,000 of debentures have now been issued, and release is obtained from corresponding obligations. Mr. Follett Holt, M.Inst.C.E., presiding at a meeting on November 24th, said that there was steady progress on the property in Venezuela. He thought 1920 there would show an improvement on 1919, especially as the local currency was on a gold basis. The property at Merida, Yucatan, had considerably improved. The net revenue at Parana was well maintained; the new year would show benefits arising from the new gas engine. Their gross revenue was approximately 30 per cent. better than in the preceding year, and expenses were 16 per cent up. The net profit increased from £19,500 to £28,900. The balance sheet had been improved by the disappearance of the arrears of dividends and bills payable. The amount set aside for contingencies was the same as in previous years, and amounted to £10,000. This was in addition to the reserves set aside by the subsidiary companies, which were about £68,000. They hoped within the next few years to have such earnings as to enable them to satisfy the ordinary shareholders, and make their own bonds gilt-edged. The annual meeting takes place in Toronto on December 30th.

Monte Video Telephone Co., Ltd.—The accounts for the year ended July 31st, 1919, show that after providing for all charges in Monte Video and London, and for income tax and excess profits duty, the net profit (including an exceptionally large profit on exchange) amounts to £38,347. Interim dividends paid in May absorbed £4,343. £8,427 was brought forward, and the available balance is £42,432. £10,000 is put to depreciation of property and plant, £16,955 to reserve, a dividend for the half-year ended July is recommended of 3 per cent., free of income tax, leaving £8,964 to carry forward. The rearrangement of capital and the consolidation of the two classes of shares into one class only have been carried out. There was a continued increase in the number of subscribers during the year. Acting on medical advice, Sir John Gavey has resigned his position of consulting engineer to the company. The board place on record their appreciation of his valuable services. Mr. W. W. Cook, M.Inst.C.E., M.I.E.E., has been elected to the vacant appointment.

Prospectus.—*Newcastle-upon-Tyne Electric Supply Co., Ltd.*—The list is to close to-day Friday (or before), in an issue of 1,500,000 7 per cent. cumulative preference shares of £1 each at par. The purposes for which the new capital is required have already been explained here.

The *Times* states that Messrs. Mann, Egerton & Co., Ltd., electrical engineers, &c., of Norwich, will shortly make a public issue of shares.

Amalgamation.—A financial daily states that resolutions effecting an amalgamation of the Nitrogen Products & Carbide Co., Ltd., with the Alby United Carbide Factories, Ltd., were passed on November 27th.

Tata Hydro-Electric Power Supply Co., Ltd.—In placing the directors' report for the year ending June 30th last before the shareholders at Bombay, in October, Sir Sassoon David, chairman, explained that the construction of the hydraulic development was not yet complete, and that the Shirawata Dam was in its final stage of construction. In June, 1918, the Shirawata Dam was 30 ft. below its height, and the company confidently relied on a minimum rainfall of 100 in. at least. Last monsoon proved a complete failure, and the directors had to cut off all extra supply of power, and also reduce their supply of power to the mills to 11 hours a day. If all the textile mills had insisted on their contracts being kept literally, the company would have been hard put to it. Even then the company had had to cut off their supplies to the Bombay Electric Tramway Co., and instead received 400 H.P. Their income had been less than in the previous year, and the expenditure greater. A sum of six lakhs of rupees was carried forward to depreciation, as the directors felt that the depreciation in the past years was inadequate. The directors were unable to declare any dividend on ordinary shares, and only declared a dividend of 7 per cent. per annum on preference shares. Rs.900,000 were carried forward. The chairman stated that the 1919 rainfall had set things right. The report was adopted. A dispatch states that the Andhra Valley Power Supply Co.'s scheme is well forward and near completion.

Stratford-on-Avon Electricity Co., Ltd.—Mr. J. A. Priest presided at the annual meeting on November 27th. He said that the increased cost of materials and other difficulties, including the difficulty of obtaining sanction to make remunerative charges for current, had resulted in a deficiency of £211. They had been selling current under cost price. The necessity for their continuing their humiliating appeals to the local authority for permission to charge a little more was now at an end, for the Board of Trade had overridden the Corporation, and had practically taken the matter out of their hands. In future they could appeal direct to the Board, and could expect fair play. Work was rolling in faster than they could cope with it, and there were signs that it would continue to do so. For the last year or two they had been living from hand to mouth. Six months ago the directors offered the undertaking to the Corporation for £20,000, and the offer was turned down. If they got a good offer ought they now to sell? The shareholders must say what should be done.

Cape Electric Tramways, Ltd.—The profit and loss account for the year ended June 30th, 1919, shows a profit of £90,864, and after providing for debenture interest and redemption of debentures, and including the amount brought forward, there is a net credit balance of £47,767. There has been put to reserve £12,000, 5 per cent. is to be paid on the ordinary shares, and £11,206 is to be carried forward. During the year the tramways carried 27,993,276 passengers, giving a return of £301,792, as against 26,444,465 passengers, earning £264,138, in 1917-18—a considerable increase in both items. Working expenditure has again continued to rise owing to higher cost of supplies and materials and to further increases in wages. The influenza epidemic of October last year caused a great falling off in traffic receipts and also laid off a number of the employés. The improvement in traffic has more than set off these adverse conditions, the profits earned being an increase of £2,104 over the preceding year. No fresh capital expenditure has been undertaken, but additional rolling stock is being ordered to overcome the present overcrowding.

The Zurich Bank for Electrical Undertakings.—The report for 1918-19 of the Bank für Elektrische Unternehmungen, of Zurich, shows how seriously the company's activity has suffered from the depreciated rate of exchange in certain countries where the bank holds extensive financial interests. In 1915-16 the company was still able to pay a dividend of 8 per cent., and one of 5 per cent. in 1916-17, but in the following year the accounts exhibited only a slight surplus, whilst 1918-19 has closed with an effective loss of £905,000. The accounts are balanced with a deficit of only £165,000, but the balance sheet shows an item of "uncovered differences in exchange" totalling £740,000. The report states that the future will decide whether the amount of this deficiency will be able to be equalised later on by a recovery of the securities affected by the fall in the rate of exchange, and it then deals at length with the conditions of exchange.

Electric Welding Co., Ltd.—The accounts for the year ended November 30th, 1918, show a loss, after charging debenture interest, of £1,056, thus increasing a debit balance brought forward to £44,456, which includes £17,491 unpaid debenture interest.—*Financial Times.*

Venezuela Telephone & Electrical Appliances Co., Ltd.—The accounts for the year ended June 30th last show a profit of £21,540. £7,340 is absorbed by interest on debentures and loans, £1,547 by income tax, and £2,258 by excess profits duty, leaving £10,395. After paying 8 per cent. on the cumulative preference shares and putting £700 to first debenture sinking fund, £6,000 is added to reserve for renewals and depreciation, and £3,213 carried to undivided profits account. Telephone service receipts were £47,096, against £43,863.

West African Telegraph Co., Ltd.—Dividend for 1918 4 per cent., free of tax; £6,000 to general reserve; £90 carried forward. The revenue was £67,528 less £19,909 ordinary expenses, and £31,436 cost of maintenance of cables, payments to staff, and other war expenses.

Petters, Ltd.—Last week the Chancery Court sanctioned the scheme of arrangement with the preference shareholders raising the dividend on their original shares from 6 per cent. to 7½ per cent., the latter being the rate for the newly created preference shares.

Castner-Kellner Alkali Co., Ltd.—Net profit for year ended September 30th £190,655 plus £48,819 brought forward. Final dividend 7 per cent,, making 13 per cent. for the year. £51,876 carried forward.

United Wire Works, Ltd.—For the year ended September 30th a dividend of 7½ per cent. and a bonus of 2½ per cent. on the ordinary shares, free of income tax; £2,000 to general reserve; £3,883 to be carried forward.

British Electric Traction Co., Ltd.—Dividend on the 6 per cent. cumulative participating preference stock for the half-year ended September 30th.

Yorkshire (West Riding) Electric Tramways, Ltd.—Final dividend of 3 per cent. on the cumulative preference shares for the year 1919.

STOCKS AND SHARES.

Tuesday Evening.

Business in the industrial markets of the Stock Exchange is by no means bad. In many directions a fair amount of trade is doing, although it might well be supposed that enterprise would be diverted into the new issues whose prospectuses continue to crowd the pages of the newspapers. The Newcastle-upon-Tyne Electric Supply Co. has been offering its preference shares this week. From the investment point of view, they are a very fair security, but it is difficult to avoid the impression that a certain feeling of soreness will be left in the minds of holders of the older preference shares of the company by having this prior charge put in front of their shares. The ordinary are firmer at 18s. 6d. A number of other new issues are known to be on the way, and there is an obvious desire to get as many out as possible before Christmas. The Stock Exchange is not altogether free from apprehension, rather than fear, of a rise in the Bank Rate, and pessimism plays with hints as to the likelihood of fresh labour trouble in the near future.

Many are asking the reason for the dulness of the Underground Electric Railways issues, seeing that the trains and 'buses are full to the utmost capacity at most times of the day. Underground Electric shares have fallen, and so have the income bonds, while Metropolitans and Districts, although they show spasmodic improvement whenever Home Railway stocks advance, are far from being a good market. The same cause is operating in each case for the heaviness of prices. It is argued that the group will probably have to spend very substantial sums on renewals and extensions. Indeed, the Underground company is advertising the necessity for laying out millions on the provision of new rolling stock, 'buses, &c., and this suggests that the company will require to raise more money in the near future. With the Income Tax at 6s. in the £, and with costs as high as they are, it is deemed uncertain whether the company can maintain more than the 5 per cent. at present paid on the income bonds, while the prospect of District stock getting a dividend is still remote. The Metropolitan pays so little that even the present quotation is quite high enough on the basis of the return. Those who have faith in the development of London traffic regard the present return on the Underground income bonds, namely, 5¾ per cent., free of tax, as good enough, seeing that the bonds are entitled to 6 per cent. when this is earned. But there is not enough certainty in the immediate outlook for money to be attracted to Home Railway investments of any kind.

Brazilian Tractions have been up to 64, the Rio exchange supplying the necessary stimulus. British Columbia Electric stocks advanced appreciably. Private news from Vancouver indicates a gradual return to normal conditions, but public affairs appear to have been far from quiet—to put it mildly—a few months ago. The Mexican group is flat; once more the state of Mexico is in the melting-pot. No further changes have occurred in Anglo-Argentine Tramways. Rio Tramways bonds have hardened a point or so.

The electricity supply market is no better. Last week's falls have not been regained, and the disposition still continues heavy. No immediate relief is looked for by reason of the reduction in the price of coal, although this is a factor that will operate favourably, of course, later on. Meanwhile the consumer knows that he, also, must wait before he is likely to derive any benefit in his lighting bill. Mr. H. B. Renwick, as chairman of the Provincial Electric Supply Committee, points out that the cost of coal is only one of the very many other costs, and that existing stocks of coal, bought at the old prices, have first to be used up. The only movement in the share-list is ¼ decline in St. James' and Pall Mall.

Marconis have again given way on the eccentric delay of the directors in announcing the price at which the new shares are to be offered to proprietors. The ordinary man sees no

cogent reason why this should not have been settled a month ago. Absence of news is quoted in the Stock Exchange as a probable cause of shareholders becoming what the soldier calls fed-up with waiting. So the parent shares have fallen to 5½, Americans to 30s. 6d., and Canadians to 14s. The Monte Video Telephone Co.'s net profit rose from £27,800 to £38,300, the movements of the exchange materially assisting, but the dividend is kept at 6 per cent., the appropriation to reserve being substantially advanced. The price of the shares is 25s. The West African Telegraph Co.'s net profit of £16,000 is over £6,000 better than that in the preceding year. The dividend remains at 4 per cent., tax free, the reserve fund is raised to £333,300, and ninety pounds is carried forward.

The buoyancy of the industrial market received something of a check by reason of the threat of the Welsh miners to resort to "direct action" if they had to pay income tax on less than £250 per annum. This threat veiled but thinly the possibility of labour troubles on the grand scale so unhappily popular with agitators the world over. The reduction in the price of coal is tempered to the consumer by his anxiety lest he shall be unable to obtain a supply.

Prices of armament, iron, coal, steel and similar shares are heavy. Babcock & Wilcox make an exception to the same tendency in the engineering group, the price having stiffened to 3¼. Callender's have regained their last week's loss. Telegraph Constructions, with an improvement of 10s., have begun to move upwards. General Electric preference weakened to a pound, and Metropolitan-Vickers preference shed 3-16, while British Aluminium are a few pence lower. The Rubber share market is uninteresting, for in spite of a rise to 2s. 6d. in the price of the raw material, buyers of the shares are not attracted.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Dec. 2, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	8	5⅝	—	£7 2 3
Charing Cross Ordinary	4	4	3	—	6 8 0
do. do. do 4½ Pref.	4½	4½	3	—	7 10 0
Chelsea	5	3	3	—	5 0 0
City of London	8	8	11½	—	6 17 8
do. do. 6 per cent. Pref.	6	6	9½	—	6 9 9
County of London	7	7	9¾	—	7 11 4
do do. 6 per cent. Pref.	6	6	9½	—	6 9 9
Kensington Ordinary	7	6	4¾	—	6 6 4
London Electric	Nil	Nil	1½	—	
do. do. 6 per cent. Pref.	5	5	3⅝	—	8 17 10
Metropolitan	4	5	3½	—	7 18 10
do. 4½ per cent. Pref.	4½	4½	3¼	—	7 4 0
St. James' and Pall Mall	9	10	6	— ¼	8 6 8
South London	5	5	2½	—	7 8 6
South Metropolitan Pref.	7	7	1	—	7 0 0
Westminster Ordinary	9	8	6½	—	7 5 6
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	20½	— ¼	6 12 8
do. Def.	1½	33/8	22	—	7 11 0
Chile Telephone	8	8	6¼	—	6 3 1
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	16⅝	— ½	*4 17 0
Eastern Tel. Ord.	8	8	16¾	—	*4 15 0
Globe Tel. and T. Ord.	7	8	16½	— ½	*4 18 6
do. do. Pref.	6	6	10⅜	— ⅛	5 18 5
Great Northern Tel.	22	22	36¼	—	8 6 0
Indo-European	13	13	48½	—	6 18 4
Marconi	20	25	5¼	— 1/16	4 11 0
Oriental Telephone Ord.	18	10	2	—	4 14 1
United R. Plate Tel.	8	8	7½	—	*5 2 5
West India and Panama	1/8	1/8	1 7/16	—	Nil
Western Telegraph	8	8	17½	—	*4 11 5
Home Rails.					
Central London Ord. Assented	4	4	58½	—	6 16 9
Metropolitan	1	1½	24	—	5 4 2
do. District	Nil	Nil	30¼	—1	Nil
Underground Electric Ordinary	Nil	Nil	2½	—	Nil
do. do. "A"	Nil	Nil	6/8	—6d.	Nil
do. do. Income	4	5	87	—1½	*5 15 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½	—	7 1 2
Anglo-Arg. Trams. First Pref.	5½	Nil	8¼	—	—
do. do. 2nd Pref.	—	—	3½	—	—
do. do. 5 Deb.	5	5	66 xd	—	7 10 5
Brazil Tractions	—	—	63¼	+ 1½	—
Bombay Electric Pref.	6	6	13½	—	4 9 0
British Columbia Elec. Rly. Pfce.	5	5	59½	+ 2½	8 8 0
do. do. Preferrred	Nil	2½	49½	+ 3	5 5 3
do. do. Deferred	Nil	Nil	43½	+ 2	Nil
do. do. Deb.	4¼	4½	61	—	6 19 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	42½	—4½	Nil
do. 6 per cent. Bonds	Nil	Nil	82	—3	Nil
Mexican Light Common	Nil	Nil	25	—	Nil
do. Pref.	Nil	Nil	25	—7½	Nil
do. 1st Bonds	Nil	Nil	54½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3¼	+ 1/16	*4 12 4
British Aluminium Ord.	10	10	1 3/16	— 3/16	6 5 5
British Insulated Ord.	25	12½	2 1/16	—	6 1 1
Callenders	25	25	8¾	+ ¼	7 9 3
,, 6½ Pref.	5	6½	6	—	6 10 0
Castner Kellner	25	20	2¾	—	7 12 8
Crompton Ord.	7	10	21/6	—	9 6 0
Edison-Swan, "A"	—	10	1¾	—	8 8 6
do. do. 5 per cent. Deb.	4	5	81¼	—	6 2 9
Electric Construction	10	10	1 1/16	—	8 8 5
Gen. Elec. Pref.	6	6½	1	—1/-	6 10 0
do. Ord.	10	10	2	—	*5 0 0
Henley	25	25	2½	—	5 11 1
do. 4½ Pref.	4½	4½	3½	—	6 4 2
India-Rubber	10	10	18½	+ ½	*5 8 1
Met.-Vickers Pref.	—	—	2 3/16	— 1/16	5 14 0
Siemens Ord.	—	10	28/-	—	*7 2 10
Telegraph Con.	20	20	25½	+ ¼	*4 16 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, December 2nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£95	£15 inc.
a Ammonia, Muriate (large crystal)	,,	£75	£7 inc.
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£39	..
a Copper Sulphate	,,	£41	..
a Potash, Chlorate	per lb.	1/1	..
a ,, Perchlorate	,,	1/3	..
a Shellac	per cwt.	£98 10	£4 inc.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	,,	£36	..
a ,, Lump	,,	£26	..
a Soda, Chlorate	per lb.	6d.	..
a ,, Crystals	per ton	17/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£98 to £392	..
c Brass (rolled metal 2' to 12' basis)	per lb.	1/1½	..
c ,, Tubes (solid drawn)	,,	1/8 to 1/9½	½d. dec.
c ,, Wire, basis	,,	1/3½	..
c Copper Tubes (solid drawn)	,,	1/7½	..
g ,, Bars (best selected)	per ton	£144	£6 dec.
g ,, Sheet	,,	£144	£6 dec.
g ,, Rod	,,	£144	£6 dec.
d ,, (Electrolytic) Bars	,,	£109	£9 dec.
d ,, ,, Sheets	,,	£156	..
d ,, ,, Wire Rods	,,	£124	£4 dec.
d ,, ,, H.C. Wire	per lb.	1/8	¾d. dec.
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
a German Silver Wire	,,	2/6	..
h Gutta-percha, fine	,,	10/- to 11/-	..
h India-rubber, Para, fine	,,	2/6	..
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£49	..
g Lead, English Pig	,,	£40	£4 15 inc.
g Mercury	per bot.	£31 10	£4 to £4 5
e Mica (in original cases) small	per lb.	6d. to 4/6	..[inc.
e ,, ,, ,, medium	,,	5/- to 10/-	..
e ,, ,, ,, large	,,	12/6 to 25-/- up.	..
g Phosphor Bronze, plain castings	,,	1/6 to 1/9	..
g ,, ,, rolled bars & rods	,,	2/3 to 2/6	..
g ,, ,, rolled strip & sheet	,,	2/6 to 2/9	..
d Silicium Bronze Wire	per lb.	1/8½	½d. dec.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	£201	£11 inc.
g ,, Wire, Nos. 1 to 16	per lb.	4/3	..
White Anti-friction Metals	per ton	£60 to £396	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
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Heating Trains Drawn by Electric Locomotives.

— A report presented at the Atlantic City convention of the American Railroad Association, by the committee on design, maintenance, and operation of electric rolling-stock, is devoted entirely to the heating of passenger trains drawn by electric locomotives. According to the *Elec. Railway Journal*, early oil-fired boilers were abandoned owing to accumulation of carbon on the tubes, trouble with back draughts, and difficulty in regulating the supply of oil and water. Electric boilers were found to be expensive to build and maintain. An improved oil-fired boiler developed in 1916 and fitted to 29 locomotives is 39 in. diameter, has 1,380 copper flues 30 in. long by ½ in. diam., 436 sq. ft. heating surface, and a capacity of 2,200 lb./hr. at 110 lb. pressure. Full steam pressure is developed within 10 mins. from starting the fire, and steam is used instead of compressed air for atomising the oil directly a pressure of 50 lb. has been developed. The steaming capacity of the boiler is increased 32 per cent. by providing free exit for gases from the outer tubes by raising the smoke box from 1½ in. to 10½ in. above the top flue sheet. An important feature is the use of a superheater in conjunction with the boiler. About 15 deg. superheat is recommended; this reduces the steam consumption required to heat cars, without damaging the steam hose and gaskets. This type of boiler is standard for electric passenger locomotives on the New York Central; the Chicago, Milwaukee, and St. Paul; and the New York, New Haven, and Hartford Railways. It has been adopted for the electrified zone of the Canadian Northern Railway, where the heating plant is on a trailer instead of on the locomotive. In each case the cars are heated from a steam-header at terminals before the engines are attached or are delivered properly heated by the steam locomotives. No complete data appear to be available concerning the steam requirements of coaches. The fire risk of an oil-fired boiler is lower with gravity feed than with air-pressure feed for the fuel. There are conditions, such as very long tunnels, which make desirable the evolution of an electrically-heated boiler.

THE STATUS OF AN ENGINEER: SOME LEGAL QUESTIONS.

From a Legal Correspondent.

In view of the fact that a Bill is shortly to be presented to Parliament to regulate the use of the title "Civil Engineer," it may be useful to consider the matter in its legal aspect.

Those who by education and training are justly entitled to describe themselves as "engineers" are naturally jealous of the use of that title; but at the present time the law affords them no protection. Anyone may call himself an "engineer" or a "consulting engineer." Nor is the professional conduct of an engineer in any way controlled by the legislature. Touting and advertising offend against no Act of Parliament; and it is in this respect that for good or ill, there is a great difference between the brotherhood of engineers and the other learned professions.

Mr. Valentine Ball in his work "The Law Affecting Engineers" (p. 2) thus emphasises the difference: "The General Medical Council, for example, exercises certain disciplinary powers over registered medical practitioners. If a doctor is guilty of nefarious conduct in a professional respect he may be deprived of the right to practice. It has been held, moreover, that the powers of this court are not limited to matters which would be dealt with in the Law Courts. Thus a doctor who advertises can be struck off the register.

"Again, the State exercises control over those who practice dentistry. A man who improperly assumes the title of dentist may be struck off the register, while it has lately been decided that anyone who adopts a title which is calculated to lead the public to believe that he is qualified as a dentist in the popular sense may be prosecuted and fined. In the profession of the law the Incorporated Law Society can deal with solicitors, while the benchers of the Inns of Court have power to supervise the actions of every member of the Bar. But the engineering profession has no domestic body to control and prescribe rules of conduct for its members."

The first difficulty which occurs to anyone who desires to bring *engineers* under control is one of definition. The term "civil engineer" was defined by O. Masselin in his work on "Responsabilité des Architects," sec. 38, to be: "a man who has, or professes, knowledge of the design and construction of works not falling within the definition of dwelling-houses and churches, or like edifices, *i.e.*, of bridges, docks, harbours, railways, roads, embankments, water, drainage and gas works, and factories."

To judge from the summary of the proposed Bill which appears on p. 600 of the Electrical Review for November 21st, it is not apparently proposed to define the term *civil engineer*, but to restrict the right to use that title to persons whose names appear on a certain register. In this respect the proposed legislation will be on the same lines as that which brought the Medical Register into existence.

No doubt those who have framed or are to frame the Bill will be properly advised as to the words which should be used to secure protection for those whom it is intended to protect; but it is not an easy matter. At the most it is proposed merely to restrict the title of "civil engineer" to those who possess certain qualifications.

Various cases decided in relation to medical practitioners, dentists, veterinary surgeons, and patent agents show how difficult it is to gain the desired object even by means of the most carefully selected words. One or two examples relating to patent agents deserve notice. The Patents and Designs Act, 1907, provides that "A person shall not be entitled to describe himself as a patent agent, whether by advertisement, by description of his place of business, by any document issued by him, or otherwise, unless he is registered as a patent agent in pursuance of this Act." Contravention of this provision may involve a fine of £20. In the case of Graham *v.* Tanner (1912), 24 T.L.R. 29, it appears that the respondent issued a circular to a person who had taken out a provisional specification in which, after describing his firm as "engineers and experts," he continued: "Our arrangements permit of us quoting the lowest charges for protection of inventions here and abroad. . . . We prepare complete specifications. . . . Our charges for preparing and filing specifications for home patents including stamp duty (the charges were set out). Exclusive business relations and wide experience in patent matters qualify us to act as your confidential advisers and to carry out your instructions to the best advantage. . . . It will pay you to employ us as your agents." On the document were printed by means of a rubber stamp the words: "All specification work prepared and revised by a registered patent agent." Short of using the actual words it were difficult to select language more apt to describe the alleged qualifications of the respondent. Yet it was decided by two judges that he had not described himself as a patent agent within the meaning of the Act.

The later case of Hans *v.* Graham (1914), 3 K.B. 400, is even more striking. There the appellant who was not a registered patent agent, occupied premises on which were affixed the words "Patent Agency" and "Patents, Designs and Trade Marks." It was held that he had not contravened the section. Mr. Justice Ridley said: "In this case I find it impossible to say that by the use of the words 'Patent Agency' the appellant was holding himself out as a patent agent when in Kennard's case ((1914) 1 K.B. 92) we held that to put up the words 'Canine Surgery' did not describe the occupier of the house as a veterinary surgeon."

It follows from these cases that merely to proscribe the use of the title "civil engineer" might not effect the object of the promoters of the Bill. An unqualified man might put the following on his billhead: T. Jones, Engineer: Civil Engineering Offices at 404, Ludgate Hill, without contravening the provision. It would seem that some rather wider form of protection would be necessary involving the use of language similar to that which is to be found in sec. 40 of the Medical Act, 1858.

We do not know whether it is in contemplation to formulate any rules of professional etiquette; but it is worth while reminding those who have this Bill in hand that certain rules were suggested by a special committee of the Institution of Civil Engineers in 1902. They were as follows:—

1. No consulting engineer should solicit employment as consulting engineer verbally, by letter, by agent paid by commission or otherwise, or by any other means.

2. No consulting engineer should answer advertisements for consulting engineers.

3. No consulting engineer should advertise for employment.

4. No consulting engineer should pay by commission or otherwise anyone who introduces clients.

5. No consulting engineer should receive trade or other discount, or surreptitious commissions or allowances in connection with any work which he superintends.

6. A consulting engineer who is directly or indirectly interested in any contracting or manufacturing business should inform his client in writing what his connection is with such contractor.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Inaugural Address of Mr. Roger T. Smith, President.

(*Concluded from page 681.*)

But essential as cheap electricity is for railway electric traction, a cheap supply is only one and possibly not the most important requirement.

The locomotive working costs of a steam railway such as has been taken as typical when comparing passenger with goods and mineral working is one-third of the total traffic expenditure incurred in working the railway including locomotive repairs, maintenance and depreciation, and, of this third, coal and water which were in 1913 one-third now amount to about two-fifths. Roughly, electricity corresponds to and replaces steam-locomotive coal and water in cost, so that for main-line electrification electricity will figure as something of the order of 13 to 15 per cent. of the total traffic costs of running the railway.

To the railway what is of greater importance than the cost of electricity is security of supply, and the policy of the railway companies in building their own power stations and in wishing to keep those that they have built is chiefly for security of supply.

Railways work under statutory obligations, and before they depend on others than themselves for their supply of tractive power they must be sure that the supply will always be available, in the quantities they require at any moment, and in case of curtailment of supply, that the railway has the first consideration.

For railways taking a supply from other power stations than their own the geographical position of the latter relative to the railway is a matter of importance from the point of view of cost. The working-pressure transmission of a main-line railway is necessarily long and if, in addition, the sub-stations are a long way from the power stations one of the advantages in cost of supply of the large common power stations may be lost in the transmission. Knowing that the capital charges form at least 50 per cent. of the cost of electricity, railways, like everyone else, are anxious to use stations equipped with the largest possible units of power so that the capital cost may be a minimum. In a recent paper* Mr. J. S. Highfield gave an analysis of present-day costs of stations and of generation which shows that a difference of £18 in the capital cost per kilowatt of load in favour of a station capable of supplying 50,000 KW. above a station capable of supplying only 6,000 KW. of load was all wiped out by the cheapest possible high-pressure transmission at 33,000 volts in a distance of 15 miles with underground cables and in a distance of 30 miles with overhead cables.

The great capital cost of high-pressure transmission, coupled with the need for security, is the principal reason why railways have in the past preferred stations on their own property in spite of the disadvantages of smaller units of power and hence higher capital and working charges than in large common power stations.

I hope, however, that the working of the Electricity Act when it is passed may result in railways reaping the advantage of supplies from stations of low capital cost per kilowatt, possessing considerable diversity of load, so situated that they may be able to supply electricity cheaply at the sub-stations, and so worked that the railway may have security of supply.

We have in this country examples both of high-pressure direct-current electric traction and of high-pressure single-phase electric traction. Both have been successful, and it is quite possible that under certain conditions as great economy may be obtained by the use of single-phase current provided that a single-phase supply is obtainable at a price which compensates for the higher efficiency and less cost of the direct-current motor on the train, and the increased losses in the return through the rails with alternating current. But in a majority of cases where economy was a first consideration careful estimates of both single-phase and high- or low-pressure direct-current traction have shown capital and working costs so decidedly in favour of direct current that those responsible for the expenditure had no hesitation in adopting the latter system.

Whether the railways are worked as a whole or as separate concerns, if main-line electrification is to be carried out it is necessary that an electric locomotive should work anywhere, and it is certainly desirable that one system should be adopted for the whole country for main line as apart from suburban traction. So far as our present knowledge goes the railways of the whole country would be more economically electrified by direct current than by alternating current.

The Ministry of Transport will doubtless review the whole situation before coming to a decision, but for the purposes of this address I propose to assume that any main-line electrification will be by means of high-pressure direct current.

Although there are instances to the contrary in Great Britain, it may be stated as a general rule for suburban service that it is not worth while to electrify for a service to be run by multiple-unit rolling stock unless a pair of tracks can be set apart wholly for the service. This condition obtains on a majority of the main-line railways which have suburban electric services and on one of them, where the suburban electric service interferes with the main line, a scheme is ready for extensive alterations to ensure the isolation of the suburban tracks. In general it is fair to assume that whatever system or voltage is in use for suburban services, this will not interfere at all or only to a limited extent with main-line electrification.

At present there is no need to fix a standard pressure or pressures for direct-current main-line working, nor has the matter yet been sufficiently discussed. Presently it will have to be fixed, but nothing has yet been done in the way of railway electrification which anticipates a decision or will prevent it being decided entirely on its merits. On its Manchester and Bury line the Lancashire & Yorkshire Railway has shown that the protected third rail designed by Sir John Aspinall can be used most successfully at 1,200 volts, and it is equally certain that, perhaps with some modification, it will be as successful at 1,500 volts. There are many places where overhead conductors are not desirable and others where they are not possible, and should this type of protected third rail be acceptable the maximum pressure at which it can be run will form the, or one, standard voltage.

The fullest consideration will then have to be given whether a pressure of, say, 1,500 volts is high enough for main-line electrification or if double this pressure will be needed for overhead equipment. Fortunately this decision will not have to be taken in a hurry, but if two pressures have to be used for main-line electrification, locomotives must be able to use both.

Suppose that a dozen contactors are wanted to control each pair of high-pressure direct-current motors at the lower pressure, then to enable the locomotives to work also at double this pressure some 30 contactors may be required.

Speed control by shunting the field goes far to remove perhaps the only disadvantage of the series motor, namely, that it has only one speed for each load. In favourable cases field control may reduce rheostatic losses during acceleration by as much as 50 per cent., and the additional running speeds obtainable are essential for main-line working.

The economy over the wearing away of wheel tires and brake shoes by turning the series electric motor into a shunt-wound generator and returning a part of the energy otherwise lost in braking to the line by regenerative electric braking, is so obvious that it must always appeal to the engineer in spite of its difficulties. If it is required, then more contactors are needed, and should it be necessary to run a locomotive at two direct-current pressures one double the other, to employ shunt field regulation and to have regenerative braking, the 12 original contactors may be multiplied by four at least to give the necessary changes in the connections.

The cost and maintenance of so large a number of contactors becomes a serious item, and until considerable experience has been obtained in their manufacture and maintenance they are the most likely source of failure.

Much consideration must be given to these and other matters before the standard pressures for direct-current main-line working can be settled, especially whether there shall be two pressures or only one.

Electrical Machinery for Handling Goods and Minerals.

The limitations of an address do not admit of dealing adequately with the subject of railway electrical machinery for handling all sorts of general merchandise, goods and minerals. The subject is almost as essentially a railway problem as electric traction, but only a few general remarks are possible.

Perhaps it will surprise many electrical engineers to see from the table given for the use of electricity by 14 British railways that in 1918 these railways required 118,000,000 KW.-hours for lighting and power; 29 per cent. of this was purchased and the annual one-hour load factor of this was 18 per cent. It will be appreciated how difficult it is to get the maximum one-hour demands correctly, and this is probably too low. The annual one-hour load factor of the electricity generated by the railways for lighting and power was 32 per cent., varying from a minimum of 10 per cent. to a maximum of 48 per cent., and for the whole use generated and bought 26 per cent.

It is interesting to note from the American return that their load factor for lighting and power is appreciably higher and of the order of 45 per cent.

The proportion of the total KW.-hours used in railway docks and in goods stations and yards may not be very great, but at the present time much attention is being paid to the mechanical handling of goods.

General merchandise is carried by railways at rates which may or may not include collection and delivery by the railway. A large proportion of the general merchandise is both collected and delivered, and the general internal trade of the country has during very many years been built up on this method, resulting in the handling of a vast number of pack-

* Elec. Rev., May 23rd, 1919.

ages of all sorts, shapes, sizes, and weights, each of which has to be checked in the goods station with its consignment note. This demands a special staff of men in a goods station for examining each article. Any method of handling goods mechanically will not dispense with these men, and the faster goods are moved in the station the more men will be required to examine and check them, otherwise the speed of the handling machinery will depend on the speed of the checkers and callers off.

The whole railway methods of handling and hauling goods traffic have been built up gradually to suit the trader's requirements, and it must not be forgotten that, however much those requirements and the corresponding railway methods may be criticised, any complete system of mechanical handling must change the trader's methods of conducting his business, which is a far bigger matter than the design and installation of the mechanical appliances.

Under the present methods of working railway engineers have designed many schemes of conveyors and transporters which have been carefully considered, but few if any of them have been commercially acceptable.

In dealing therefore with general merchandise, where baskets of tomatoes or bags of potatoes may be followed by a ton of glass or a summer house, the mechanical appliances in goods stations consist generally of machinery for dealing with articles too heavy to be moved by hand. Fast travelling and traversing overhead electric cranes are ideal for this purpose since the goods platforms are left quite free. Without going into the reasons which usually require that in a goods station the roof stanchions which also support the crane gantry are spaced down the middle of a platform, it is becoming usual railway practice to attach a revolving jib to the bottom of the crab. This jib passes between the stanchions and is of such a length that the hook can command a siding or a cart road beyond the crane gantry on either side.

Until the entire habits of the traders are changed it does not seem possible to deal with general merchandise wholly by mechanical means, much as it would be to the advantage of the railways to do so. If it were possible the engineering problem with electrical machinery is quite straightforward. In a busy goods station in the west where two overhead cranes with underhung revolving jibs command the platforms, sidings and cart road and are generally in constant use day and night, careful checkings have shown that not more than 3 per cent. of the total weight of general merchandise handled in any one day is moved by the cranes. Where existing buildings do not allow head room for overhead cranes or runways, electric jib cranes either fixed, or travelling on a mono-rail, are the only lifting appliances available, but they are a very poor substitute for the overhead travelling crane.

Travelling appliances transfer the goods from wagon to cart, or *vice versa*, and the overhead travelling crane comes to the wagon wherever it is and goes to the cart wherever it is, or *vice versa*. Power appliances are also required to move the wagons themselves, either full or empty, and include electric wagon lifts where station and yard are at different levels, wagon traversers to transfer wagons to or from any siding, turntables and capstans, and examples of such electrical machinery are to be found all over the country. A great deal of trouble has been taken to render the Clyde type of electric capstan suitable for railways. This capstan has a steel wire rope fixed to a free barrel, the barrel being clutched to the motor through the reduction gearing only when current it applied. As compared with the usual type of capstan with a barrel permanently connected to the gearing and a hemp rope slipping on the barrel the saving in the cost of ropes is from 80 to 90 per cent., and this saving generally more than pays for the energy, which is reduced by 50 per cent., as also is the power.

In a goods yard the Goliath type of overhead travelling crane with a crab traversing along a bridge carried by a leg at or near each end and spanning one or more sidings and a cart road is the most useful loading and unloading appliance. The whole structure travels up and down the yard and with electric capstans usually completes the yard equipment, though one or more jib cranes at points inaccessible to the traveller may also be necessary. Some very fine examples of Goliath electric cranes up to about 50 tons' capacity are to be found in our railway yards.

When instead of general merchandise of all sorts of shapes, sizes and weights special goods of nearly uniform size and weight have to be dealt with in large quantities such as bales of cotton, cases or boxes of food or merchandise; coal, ores or other minerals and grain of all sorts the whole can be loaded, transferred and unloaded mechanically and electrical machinery is by far the most suitable where the work cannot be done by gravity. Doubtless a great deal remains to be done in the application of conveying or transporting machinery for such purposes, and this especially applies to docks and harbours, although several railway docks are well equipped with electrical machinery.

For dealing rapidly with large quantities of material of about the same size and weight, it is possible to design a conveyor to meet almost any requirement, supplemented with apparatus for loading on to the conveyor and for receiving the conveyed material. Excellent examples of conveyors for dealing with coal, ore, china-clay and other minerals have been provided by railways at their docks or harbours, but much remains to be done.

General Use of Electricity by Railways.

In addition to a large electric lighting load and a certain amount of heating and cooking, electricity is also used by railways for opening and closing Scherzer bridges, for working all classes of general machinery and in most departments of their locomotive, carriage and wagon works for driving machine tools, while the use of the electric vehicle from a 5-ton lorry to a platform trolley is increasing rapidly.

A word may be said about electric-train lighting, which is one of the most difficult problems with which railway electrical engineers have to deal. The electrical apparatus is an automatic central station, which ought to run for a month without attention. Essentially it consists of a battery, with a dynamo and with control gear to render the output of the battery continuous. By the use of the variable-speed dynamo in which the voltage is roughly constant, or under control between a lower limit and the maximum obtainable speed, the power taken from the locomotive driving each dynamo through a carriage axle may be reduced to reasonable dimensions. Railwaymen have been so intent on getting the whole plant reliable that not enough attention has been paid to economy in power. Experiments with different dynamos show for the variable-speed type at high speeds a saving over the non-variable speed type of some 40 per cent. in the power taken from the locomotive for lighting.

Railway electrical engineering is a special branch of the profession demanding as much knowledge as can possibly be obtained of general railway conditions. An engineer requires all his youth for his engineering training and most of his manhood and middle age as well. He can usually only hope to pick up a smattering of general railway knowledge at second hand, and his success as a railway electrical engineer will largely depend upon his ability to absorb the knowledge and experience of his colleagues in other departments and from the railway staff in general. Railway electrical engineering, apart from telegraphs and telephones, is almost wholly a development of this century, and it has undoubtedly proved its usefulness. But it depends as much on the personal character as on the professional ability of railway electrical engineers and on their honesty in solving the many problems which are set them by the management whether railway electrical engineering serves the railways, and through them the community at large, in the way in which it ought to serve both. I hope that this Institution will take a larger interest than it has done before in railway electrical engineers and that they in turn will in increasing numbers support this Institution.

IRISH CENTRE.

Mr. R. Tanham, chairman of the Irish Centre (Dublin), delivered his inaugural address at a meeting held on October 16th. In the course of his address he said: * The country is to-day compelled to consider the subject of fuel economy. The value and necessity of developing our peat and water resources has been shown on several occasions. The former may ultimately be the solution of power distribution in Ireland, the latter, where within reasonable distance from the place of demand, and where the whole of the power can be absorbed during the day and night, should be immediately developed, linked up electrically and connected to existing steam stations, and we should also look into the question of adopting suitable apparatus and methods for using different kinds of coals not hitherto regarded as suitable or commercially available. The three natural resources of power in Ireland, namely, peat, water, and coal, have recently been the subject of investigation by three separate Government Committees, and their reports are awaited with the greatest interest. This country is at the mercy of every strike or industrial disorganisation, and it is not possible to build up sufficient reserve stocks. Great Britain may have to reduce our fuel requirements at any time, and facilities should be granted towards the rapid development of our power resources. Every power station and consumer of coal has had to adopt means of more efficiently utilising supplies, and I would like to refer briefly to the results obtained in electric power stations. The progress that has been made and the increased efficiency obtained with the growth of the power station industry is remarkable; the power station industry has now become a necessity to the economic life of the nation. We have in Ireland 13 power stations using coal and furnishing technical returns to the Board of Trade Coal Mines Department. During the year ended March, 1918, the total number of units generated by these stations amounted to 59,159,700. The total consumption of coal in the 13 stations amounted to 117,640 tons. The following year ending March, 1919, the number of units generated was reduced by 3,119,365, and a saving of 5,667 tons of coal effected. Electric power stations in Great Britain and Ireland using coal or coke fired boilers have been divided into areas and groups. Area No. 22 denotes Ireland, and the figures obtained last year give her twelfth place on the list of areas arranged in the order of lowest area average for lb. of fuel consumed per unit generated, and seventeenth place on the list of areas arranged in the order of highest thermal efficiency. The average consumption of fuel per unit generated in Ireland last year was

* *Irish Builder and Engineer. Abstract.*

4.5 lb., and in the United Kingdom 3.459 lb. The average calorific value of the coal delivered at my station during the year ending March, 1918, was 11,050 therms per lb., and last year the average fell to 9,840 therms per lb. The thermal efficiency of this station during the first-mentioned year was 9.02 per cent. and last year 8.9 per cent. The coal consumption per unit generated increased from 3.41 lb. in 1918 to 3.9 in the year ending March, 1919. The number of therms used per watt-hour generated was 37.68 and 38.77 respectively, for the two years under review. These figures may be taken as the best that can be obtained in Ireland under prevailing conditions in stations using coal-fire boilers. The highest thermal efficiency of any power station in Great Britain and Ireland generating between 3 and 15 million units per annum during the year ending March, 1919, was 11.19 per cent., and the lowest fuel consumption per unit generated was 2.61 lb. There are 114 power stations in this group, and four of them are situated in Ireland. For power stations generating between 15 and 50 million units per annum—and in this group there are 53 stations—the lowest fuel consumption per unit was 2.19 lb., and the highest thermal efficiency 14.05 per cent. Altogether there are 438 power stations included in the complete summary of the coal mines department. Eighteen of these are stations generating over 50 million units per annum, and the total number of units generated last year by these 18 stations was 2,038,492,583, while the total for the whole 438 stations was only a little more than double this figure. The highest thermal efficiency obtained last year at any station in Great Britain was 18 per cent., and the lowest fuel consumption per unit generated 1.8 lb. Members will have noted the remarkable results concerning the working of the Conners Creek power station where the KW.-hour is generated for a consumption of 1.42 lb. of coal, and electrical engineers hope to keep on improving efficiency to reach the ideal now desired, viz., one KW.H. delivered on the switchboard for each pound of coal consumed. Your past chairman, the late Mr. J. P. Tierney, in his address referring to the electrification of railways, gave 6 lb. of coal per horse-power-hour for steam locomotives. If we take figures for power stations and distribution efficiencies now admitted to be within the range of established working conditions, we have 1.8 lb. of coal per unit, allowing about 10 per cent. for falling-off of plant efficiency and varying conditions of operation, we arrive at a figure of 2 lb. of coal per KW.H. The efficiency for conversion and line losses representing American railway practice are as follows: Step-up transformers 98.5 per cent., step-down transformers 97.5 per cent., conversion plant 88 per cent., trolley line 90 per cent., electric locomotives 88 per cent. The combined efficiency from the switchboard to the draw-bars of the electric locomotive works out at 63.4 per cent. We thus arrive at a figure of 2.35 lb. of coal per horse-power-hour at the locomotive. It would appear from this that coal conservation by electrification of railways is likely to be carried through at a rapid rate in the near future, particularly on suburban lines and where a large amount of shunting work has to be done, and most of the fuel saved would be high grade coal. There is more than one railway in our own country where an immediate saving of coal could be made, and I believe a profitable result would follow electrification of a portion of our local lines. Main line electrification will also offer considerable opportunity for coal conservation, and in this connection we may expect to hear of several interesting propositions besides electrification by means of the stationary power house and transmission lines. The thermal efficiency is a very important measure of progress; 18 per cent. was the highest attained last year in Great Britain and 8.9 per cent. in Ireland. In America during 1918 a 35,000-KW. unit reached a thermal efficiency of 21.6 per cent.; the steam turbo-generator unit has not yet reached its maximum efficiency, and in the near future 26 per cent. will easily be realised. The economies offered by large power stations reflect the greatest credit on all concerned, and when you compare the above figures with the small stations consuming from 10 to 20 lb. of coal per unit, it is not surprising that the tendency is towards the compulsory closing down of such stations. The development of the turbo-generator has been very rapid, and it is a record of progress that cannot be excelled in any other branch of engineering. This is not the end, for we are promised increased efficiency by the use of higher steam pressures and temperatures and by "bleeding" or tapping the turbine at two or more places, placing heaters in series, pumping the condensate through them in contra flow and direct from the condensers to the boilers. The economiser might be retained as a form of air heater, the air being heated by the gases and delivered to the boiler for combustion purposes. In the Conners Creek power station the heated air coming from the electric generators, steam pipes, &c., is led to the boiler furnace because for each KW. generated about 100 B.T.U.'s can be recovered. Another progressive proposal is Mr. Emmett's two fluid method, using mercury and steam. He superimposes on the steam temperature a high temperature by the use of mercury vapour. The expected efficiency is very great, meaning some 40 per cent. saving in fuel; but progress has been delayed by pressure of war work. Boiler-house improvements have also made great advances. The design and operation of automatic stokers, steam-raising devices, recorders, and auxiliaries have contributed considerably towards improving thermal efficiency. Boilers are now installed in Great Britain for an evaporation of 80,000 lb. per hour, and some are capable of an overload duty of 104,000 lb. of water per hour from and at 212 deg. F. In America at Detroit peak load duty of 100,000 lb. per hour per boiler is carried, and up to 160,000 lb. per hour expected. Boiler working pressures are also on the increase; at Glasgow 275 lb. per sq. in. is to be used at the new Dalmarnock station. At Carville power station 275 lb. per sq. in., and for the new Barton station at Manchester a boiler pressure of 375 lb. per sq. in. is contemplated. At Detroit station plant is working at 350 lb. per sq. in., and at the B.T.H. Co.'s power house at Rugby there is a 350 lb. per sq. in. pressure plant, with Babcock & Wilcox self-contained marine type boilers. After four years' continuous working, everything appeared satisfactory, and the turbine blading was found to be in first-class condition. There are 217 self-contained boiler units actually in operation, and the capacity of these boiler units varies from 25,000 to 90,000 lb. evaporation per hour. I refer to these installations to draw attention to the efforts that engineers are making towards conservation of resources and providing power at a cheaper rate. I am preparing a high-pressure boiler turbo unit scheme to compare with the running of present plant at my station, and with a view towards increased economy in connection with future extensions. The use of low grade fuel is worthy of close investigation in this country particularly. Investigation into production and methods of utilising low grade fuels and developments in other countries have demonstrated that the use of such fuels may be made to afford economies. Burning coke breeze and burning Irish anthracite is not quite the same proposition, although the average percentage of volatiles in each is about the same, there is a considerable difference in the physical properties of coke breeze and anthracite. We want to burn at least 25 lb. of coal per sq. ft. of grate per hour. The makers of the forced draught travelling-grate stokers claim that their stokers will burn Irish anthracite coal at this rate, and I understand a number of these stokers are at present being installed at the Corporation electricity works. Amongst the many other methods suggested for more efficiently utilising our fuel resources may be mentioned powdered fuel. In America the consumption of coal in powdered form is about 10 million tons per annum, the consumption approximately running out as follows: Manufacture of cement, 6,000,000 tons; iron and steel industry, 2,000,000 tons; production of copper, 1,500,000 tons; generation of power, 200,000 tons. In addition, the use of fuel in this form on board ship and on locomotives is now under way. Recent advances in this method of burning fuel have shown marked economy, and it will likely be more widely used when it is better understood. The powdered fuel system is worthy of careful investigation in this country, and should receive financial aid from the Local Advisory Committee of Scientific and Industrial Research on the lines already granted for industrial research.

THE ROADS AND TRANSPORT CONGRESS AND EXHIBITION.

THE problems of transport in this country are becoming more serious day by day. The Roads and Transport Congress and Exhibition, which was held at the Royal Agricultural Hall, Islington, London, N., from November 20th to 27th, proved, therefore, of wide interest. It was the second venture organised by the County Councils Association, and was inaugurated by a luncheon at the Holborn Restaurant, presided over by the Earl of Dartmouth, and attended by Sir Eric Geddes, Minister of Transport, who accepted the presidency of the exhibition. In view of the prominence of the housing question, arrangements were made with the Institution of Municipal and County Engineers for a Housing Conference to be held on November 27th and 28th, which was addressed by Dr. Addison, Minister of Health. A conference was also held by the London "Safety First" Council on November 22nd, when Mr. A. E. Blain gave an interesting account of the commencement and work of the movement. Conferences were held daily at which the subjects discussed included: Concrete roads, asphaltic macadam (bituminous) roads, the consolidation and amendment of the Highways Law, single and double bituminous road surfacing, conditions under which heavier types of vehicles might use roads, weight, construction, and speed of vehicles in relation to construction and maintenance of roads, and provisions for future development of traffic.

The gallery of the main hall was taken up by the Public Works Exhibition, organised by the Municipal Agency, Ltd., and in the main hall was staged a representative collection of British-made commercial road vehicles, steam, petrol, petrol-electric, and electrically driven. In addition, the exhibition comprised materials and plant for the making, maintenance, and cleansing of roads. The main features of the electric vehicles will be familiar to our readers; they formed representative exhibits of most of the leading firms in the industry.

MESSRS. RICHARD GARRETT & SONS, LTD., Leiston, Suffolk, had on view a 2.5-ton electric lorry fitted with an electrically-operated end-tipping wooden body, with fixed sides and hinged tailboard. The speed on good level roads is 10 m.p.h.,

and the distance that can be travelled without recharging is between 35 and 40 miles. The standard inside platform dimensions are 10 ft. 9 in. by 6 ft. 6 in., the overall length being 15 ft. 6 in., and width 6 ft. 11 in., with a wheelbase of 10 ft. 3 in. Solid rubber tires are fitted, single to the front and twin to the hind wheels. Over the drivers' seat a cab and awning is built; semi-elliptic springs are fitted to both axles, which are of steel and run in roller bearings. All working parts of the steering gear have case-hardened surfaces. The transmission is double reduction by silent chain, in an oil bath, from the motor to the countershaft, and continued by silent roller chains to the road wheels. The controlling gear gives six speeds forward and four reverse; it is fitted with trip gear arranged to automatically cut off the current immediately the brakes are applied, and rendering it impossible to restart until the brakes are released. Both the double external contracting footbrake and the internal expanding hand-operated emergency brake operate on brake

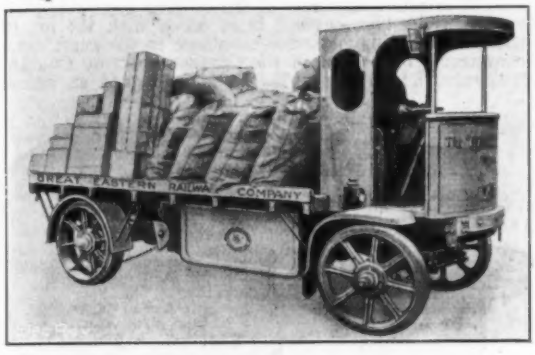
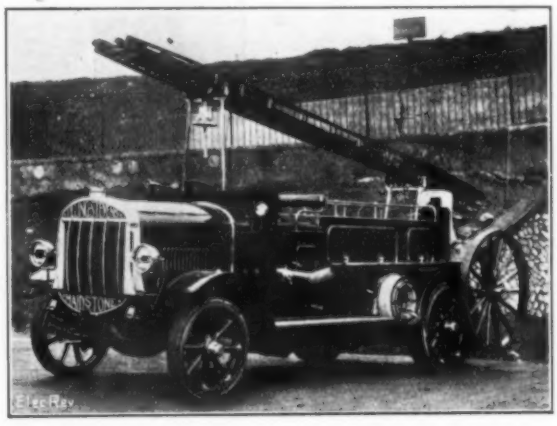
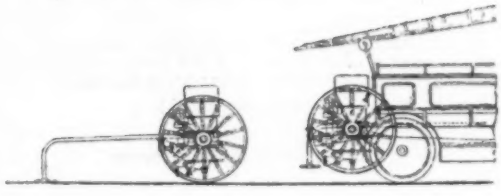


Fig. 1.—Garrett 3.5-ton Electric Lorry.

drums on the rear wheels; all brakes are lined with "Ferodo," and lubricators are fitted to all moving parts. The 44-cell Ironclad-Exide battery is of 193 amp.-hour capacity, while the series-wound motor is capable of an overload of 300 per cent. for reasonable periods. A receptacle for an E.V.C. charging plug is provided, while a speedometer, hydrometer, indicating instruments, lamps, horn, and all the usual tools and accessories are supplied with the vehicle. We were unable to obtain a photograph of the vehicle actually exhibited, which was manufactured for the Glasgow Corporation, but fig. 1 illustrates a 3.5-ton model that was supplied to the Great Eastern Railway Co.

Messrs. Tilling-Stevens, Ltd., Maidstone, exhibited a 2.5-ton chassis fitted with hand-operated tipping wagon body and a petrol-electric fire tender with escape, the ladder being of the 35-ft. trussed pattern on brass stanchions, with roller. An interesting feature was the independent electrically-driven pump of the two-stage type with a capacity of 350 g.p.m., and constructed entirely of bronze. The vertical motor and centrifugal pump are carried as one dismountable unit on a light 2-wheeled trailer which can be quickly mounted or dismounted from the rear of the engine. This is accomplished by means of a light pair of ramps, permanently fixed to the rear of the chassis and at such height that when the unit is rolled up it will slide up the ramps and be held in place by a pair of automatic clamps. The pump drive is by shunt-wound, ventilated electric motor and two cable drums are provided, each carrying 100 ft. of twin cable. Several advantages are claimed for this arrangement apart from mobility at the actual scene of the fire. By having the pump and motor vertical it is possible to place the pump very near the ground, thus reducing the suction lift and keeping the centre of gravity of the unit low. The absence of mechanical connection between the engine and pump and the use of electric regulation renders the speed of the pump controllable to suit the varying volumes of water pressures without sacrificing h.p. The chassis is of the company's well-known petrol-electric type, fully equipped with C.A.V. electric lighting. The wheel base is 14 ft. 6 in., and the maximum length 19 ft. 3 in. The frame is of pressed steel throughout, each of the main side members being pressed from one solid steel plate. The dynamo and motor are carried on two longitudinal sub-members. The engine, which is on 3-point suspension is of 45 to 50 h.p. four-cylinder enclosed vertical type with a bore of 5 in. and a stroke of 6 in. The cylinders, water-jacketed, are cast in pairs with the inlet and exhaust valves on the near side. The valves are of large diameter (the inlet and outlet valves being interchangeable) operated by a single camshaft, and easily accessible. The oil is circulated by a gear pump, the lubrication of the engine is entirely automatic, and is in no way dependent upon the driver. The ignition is by Thomson-Bennett h.t. magneto, driven from the camshaft by an enclosed skew gear. The magneto is easily removable, and can be replaced without disturbing the timing. As the magneto runs at right angles to the engine the contact breaker is very accessible for inspection. "Sphinx" sparking plugs are screwed into the valve caps. The cooling water circulating pump of the centrifugal type is driven from the same skew gear as the magneto. The controller and speed regulator are carried in separate aluminium cases. The controller is of the tramway type with screw adjustment to the contact fingers. The speed regulator is of the multiple contact type, and operates by varying the resistance in the shunt field of





Figs. 2 and 3.—Petrol-Electric Fire Engine.

the generator and by shunting the series field of the motor. Easily renewable resistance units are fixed on the base of this controller. The switches are constructed entirely of metal and micanite, no insulating compounds being used. The drive from the electric motor to back axle is by means of a propeller shaft fitted with universal joints at each end, and the back axle is worm driven, the worm being placed above the worm wheel. The steering gear is of the Ackerman type, with irreversible worm and sector which are enclosed in a dust-proof and oil-tight casing. Fig. 2 shows the Tilling-Stevens petrol-electric fire engine, while fig. 3 illustrates the method of detaching the motor-driven pump.

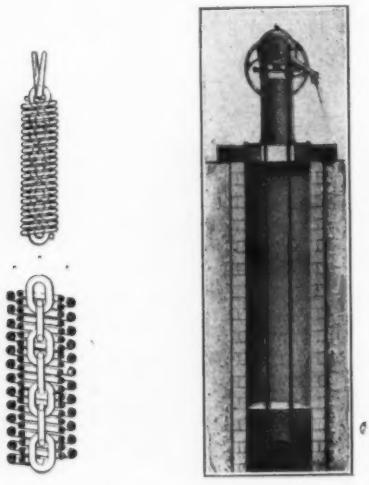
Messrs. Dennis Bros., Ltd., Guildford.—Included in this exhibit was a tower wagon mounted on a subsidy chassis, and fitted with Rawlinson elevator gear, of the central screw type, which can be operated by one man. The extended height to floor of platform is 19 ft., and the closed height 13 ft. 10 in. The machine is fitted with a 45-h.p. 4-cylinder engine, the cylinders being cast in pairs of the T-headed type. The magneto is driven by a cross shaft in front of the engine. The final drive is by overhead worm, contained in a housing forming part of the axle casting lid. The standard wheels are of the cast-steel tubular-spoke type, and large-diameter brake drums are fitted to the rear wheels. The gear box gives four speeds forward and reverse.

The Lacre Motor Car Co., Ltd., 78, York Road, King's Cross, London, N. 1, in addition to other vehicles was also showing a tower wagon suitable for tramway and other overhead work. A feature of the machine is its light yet strong construction, the various sections being framed in ash and tied together by steel rods.

Messrs. Boulton & Paul, Ltd., Norwich, had on view a working exhibit of the "Chaine-Helice" liquid elevator, which was brought out in France in 1910. The elevator is a simple and cheap means of raising water from wells, and a large number of installations were used by French and British engineers at the front. The elevator is simply placed on the top of the well, and the spiral chain lowered, when water can be pumped immediately. Installations have been made in wells 240 ft. deep without the necessity of descending the well at all, and deliveries of 7,000 gall. per hour can be obtained. The method of working is an endless chain carrying spiral coils, single or multiple, according to the amount of water required. A grooved pulley operates it from the top of the well, and a corresponding grooved pulley is suspended in the loop at the bottom of the well to keep it taut. The water is entrapped in the interstices of the spiral by capillary attraction, and is lifted until as the chain passes over the pulley at the top it is thrown off by centrifugal force. Figs. 4 and 5 show the construction of the

endless spiral chain, while fig. 6 shows the elevator ready for operation.

Amongst the advantages claimed for this form of pump



Figs. 4, 5, and 6.—Chaine-Helice Pump.

are its simplicity, absence of piping, cups, rubber, and valves; there is no fear of freezing, and the length of chain can be easily adjusted according to water level variations.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Overseas" Water Heater.

The "Overseas" safety water heater, made by the Overseas Engineering Co., Ltd., 75, Curtain Road, London, E.C., will give, it is claimed, hot water instantly, merely by turning the switch, the continuous running water being fresh, drinkable, and either hot, warm, or cold, as desired. There is no need to run any cold water away first, and the heater only consumes energy whilst hot water is being drawn. The device, fig. 1, is a nickel-plated brass fixture, and is complete with 3 ft. of nickel-plated flexible armoured wire, plug, and wall socket, so that it can be readily installed. The heater, which weighs about 2.5 lb., will operate on either A.C. or D.C., but the heating element will have a longer life on A.C. as electrolysis does not occur. Both terminals are earthed through the water, so that it is electrically safe, and in

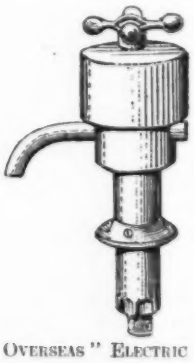


Fig. 1.—The "Overseas" Electric Water Heater.

addition it is claimed that the water is electrically sterilised; 27 gallons may be heated per hour to 82 deg. F., or 6.5 gallons to 165 deg. F. with the water supply at 52 deg. F. The consumption of electricity varies with the water heated; 7 amp. are consumed at 220 volts and 14 amp. at 110 volts. At the upper joint the rod, which is in reality a valve stem, is connected to a snap switch which thereby controls not only the electric current, but also the flow of water. The snap switch has four positions; in only one of these is the heater coil connected to the electric circuit. In two of the positions the water is turned off, while in the other two water can flow. The arrangement is such that the electric circuit cannot be completed unless water is flowing. There is sufficient play in the toggle-joints to permit adjustment of the rate of flow within certain limits, thereby regulating the temperature attained by the water before it issues from the spout. The device is economical, inasmuch as the water is heated only when desired, there being no stored volume from which heat is radiated. One turn of the switch starts the flow of water, and at the same time makes the necessary electrical connection; a second turn shuts off the flow of both water and electricity. Cold water is obtained from the same tap by a third turn of the handle, by which the flow of water only is started, and no energy is consumed. A fourth turn again stops the flow of water.

Outdoor Lightning Arresters.

For the protection from lightning of electrical plant and apparatus connected to D.C. overhead lines at pressures up to 650 volts the most satisfactory method is to use a magnetic blow-out arrester. In some of the existing apparatus of this description the blow-out coil is in series with the air gap, thereby introducing inductive resistance in the earth circuit. To overcome this objection the General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4, has designed an arrester,

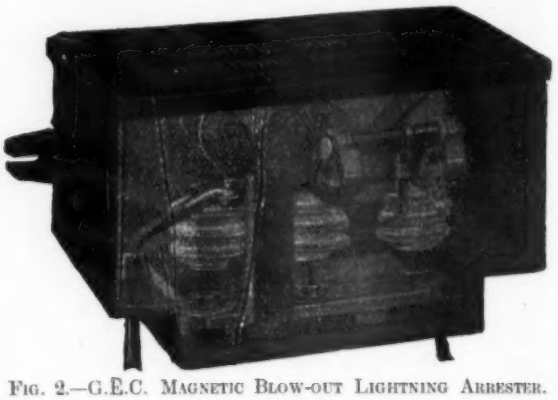


Fig. 2.—G.E.C. Magnetic Blow-out Lightning Arrester.

fig. 2, known as the O.K.M. type. In this the energising current for the blow-out magnet is shunted from a non-inductive resistance in parallel with a second air gap, and thus an effective magnetic blow-out is obtained without obstructing the path to earth for a discharge. In addition the following points in construction should be noted. The two pairs of horns are shielded with fireproof shields. The non-inductive resistance is placed on one side of one pair of horns, and the blow-out coil is placed on one side of the air-gap on which it is to act—the two pole-pieces of the magnet yoke being arranged right and left of this gap and resting flat against the insulating shields. This arrester is mounted complete in a cast-iron box with rainproof cover and two fixing lugs for mounting on a pole or outside a wall; it weighs complete 38 lb., and measures 13¼ in. by 7⅛ in. by 6¼ in.

The Dispersive Mazdalux Reflector.

A new pattern of industrial Mazdalux reflector has recently been developed by the British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C. 4. This is known as the dispersive Mazdalux reflector, fig. 3; it is made in four sizes from 13¼ in. to 22 in. diameter for half-watt type Mazda lamps

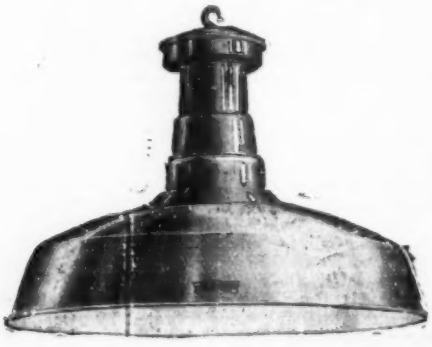


Fig. 3.—Dispersive Type Mazdalux Metal Reflector.

of from 60 to 1,500 watts. Dispersive, of course, describes the light distribution given, which is midway between the extensive and intensive form of distribution. For uniform illumination these dispersive units should be spaced a distance apart equal to 1¼ times their height above the working

plane. The angle of "cut-off" is 85 degrees, so that this reflector is particularly suited to conditions requiring the illumination of vertical surfaces. The reflector is made of sheet steel, stiffened with a beaded lower edge, and accurately formed to give the dispersive distribution. The interior is finished with white vitreous enamel, and French grey enamel protects the exterior. The reflector has a deep skirt, the

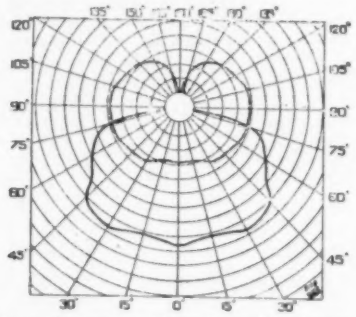


Fig. 4.—Polar Curve of Dispersive Mazdalux Reflector and Mazda Half-watt Lamp.

object of which is to increase the dispersion of the light rays to an extent impossible with other types of half-watt lamp reflectors. Dispersive Mazdalux reflectors are supplied in a modified form (known as the "Dispersa" lantern) with weatherproof housing made of cast iron, for outdoor use.

Studio Arc Lamp.

Messrs. B. J. Hall & Co., Ltd., of Chalfont House, Great Peter Street, London, S.W. 1, have on view at their office a novel form of arc lamp designed for film studio and photographic purposes. The special feature of this lamp, which is

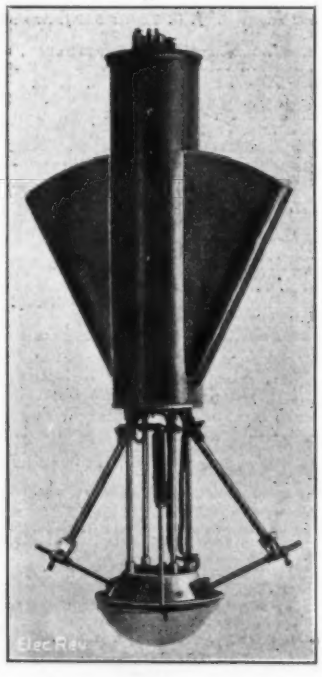


Fig. 5.—Hall Studio Lamp.

illustrated in fig. 5, is a horizontal arc with uninterrupted illumination on the under side. The lamp has been designed and built at their own works, and a patent has been applied for. Readers are invited to go and inspect it.

Synthetic Ammonia.—M. Georges Claude recently showed that it was not only possible but easy to produce and turn to industrial uses pressures of 1,000 atmospheres and more. M. Claude has now succeeded in applying these very high pressures to the synthetic production of ammonia. Under the new conditions discovered by him the combination of hydrogen and nitrogen takes place with such intensity that a very small apparatus is capable of a considerable output. Whereas the German chemist Haber only obtains one-third of a gramme of ammonia per catalytic gramme, M. Claude obtains ten grammes.—*The Times.*

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

List of further contributions received and promised up to November 28th in connection with the Annual Festival, 1919:

CHAIRMAN'S LIST.

Amount previously published	£326	11	6
Pearston, Osborne	1	1	0
Graham, E. A.	2	2	0
Higgs & Hill	2	2	0
Ives, S. P.	0	10	0
Piper, J. R.	0	10	0
Gent & Hurley	5	5	0
Keighley, L. (Miss)	0	10	0
Langridge, E. (Miss)	0	10	0
Kirk, A.	0	10	0
Mann, M. M.	0	10	0
Tavener, W. J.	0	10	0
Ellison, R. B.	0	10	0
Rawlings, W. R.	3	3	0
Gas Lighting Improvement Co., Ltd.	0	10	6
Crowden & Garrod	1	1	0
Braby, F., & Co., Ltd.	1	1	0
Carmichael, T.	1	1	0
Crapper & Co., Ltd.	1	1	0
Price, E. L., & Co.	1	1	0
Miskin & Rice	5	5	0
Parsons, E. M.	2	2	0
Wray, T.	0	10	0
Young, H. T.	3	3	0
Chesters, A. E.	5	5	0
Wallis-Jones, Capt. R. J., O.B.E., T.D.	1	1	0
Falk, D.	1	1	0
Electric Construction Co.	10	10	0
Falk, Stadelmann & Co., Ltd.	10	10	0
Cohn, A.	5	5	0
Edgecombe, J. E.	1	1	0
Wyld, W.	1	1	0
Hiatt, Dr. C. E.	1	0	0
Child, A.	0	10	6
Shiller, L. G.	0	10	6
Cunningham, R. N.	1	1	0
Cannon, A. V.	1	1	0
Cateaux, J. L.	1	1	0
Adams, L. E.	5	0	0
French, H. N.	1	1	0
Williams, W. H.	2	2	0
Vacuum Oil Co.	1	1	0
Turner, G. H., & Co.	1	1	0
Benjamin Electric, Ltd.	10	10	0
Haskell, P. J.	0	10	6
Callender, Sir Tom	10	10	0
Potter, W. J.	2	2	0
Kartret Eng. Co., Ltd.	5	5	0
Baker, C.	1	1	0
Wordingham, C. H.	1	1	0
Kipping, P. P.	2	2	0
Spagnoletti, J. E.	2	2	0
Hawes, F. B. O.	20	0	0
Electrical Times, Ltd.	5	0	0
Allen, A. H.	0	10	6
Scupham & Wood, Ltd.	2	2	0
Electricity, Proprietors of	1	1	0
Kane, S.	1	1	0
Hughman, R. W.	1	1	0
Rooper, W. O., & Co.	5	5	0
Praill, C. H.	1	1	0
Morton, W.	0	10	6
Rawlings, W. J.	1	1	0
Milne, L.	5	5	0
Harris, A. F.	1	1	0
Nalder Bros. & Thompson, Ltd.	5	5	0
Nalder, F. H.	1	1	0
Hill, J.	1	1	0
Abell, C.	1	1	0
Ross, C.	1	1	0
Howell, E. J.	1	1	0
Hare, S.	1	1	0
Walker, H.	1	1	0
Keeley, P. W.	1	1	0
Rapp, W. G.	1	1	0
Dagnell, S.	1	1	0
Ward, J. (Worcester), Ltd.	0	10	6
	£508	11	0

ADDITIONAL TO MR. H. BEVIS'S COLLECTION.

Amount previously published	£61	9	0
Pirelli-General Cable Works, Ltd.	25	0	0
Bles, D., & Sons	1	1	0
	£87	10	0

MR. J. Y. FLETCHER'S COLLECTION.

General Electric Co., Ltd.	52	10	0
Hirst, H.	21	0	0
Railing, M.	10	10	0
Fletcher, J. Y.	10	10	0
	£94	10	0

MR. C. E. HUNTER'S COLLECTION.

Edison Swan Electric Co., Ltd.	105	0	0
Henley's, W. T., Telegraph Works Co., Ltd.	25	0	0
Clarke, Ellice	10	10	0
Hunter, C. E.	10	10	0
Cross, John	10	10	0
Ford, C. J.	10	10	0
Rosling, P.	10	0	0
Quilter, E. C.	5	5	0
Duncan, Tucker & Sons	5	5	0
Altrincham Electric Supply Co.	5	5	0
Platto, F.	5	5	0
Womersley, R., & Sons	5	0	0
Marsden, J. W.	2	2	0
Bailey, S. J., & Co.	2	2	0
Cox, C. H.	2	2	0
Boys, Capt. S.	2	2	0
Etches, J. B.	1	1	0
Atkins, J. P.	1	1	0
Cromil Engineering Co., Ltd.	1	1	0
Barwell, C. J.	1	1	0
Hillbar Press, Ltd.	1	1	0
Barnett, J.	1	1	0
Melin, C., & Co.	1	1	0
Down, F. J.	1	1	0
Hall & Pickles	1	0	0
Sherwood, F. J.	0	10	6
Clark, R. J.	0	10	6
Parkes, F. W.	0	10	6
Jones, J.	0	10	6
Horsfall, H. M.	0	10	6
Eberstein, J.	5	5	0
Johnston, R., & Co.	1	1	0
Hall Street Metal Rolling Co., Ltd.	2	0	0
Elliott, J. W.	5	5	0
Child, J. S.	5	5	0
Scott-Harland, W.	1	1	0
Austin, W. H.	0	10	6
Herbert, H.	1	1	0
	£249	17	0

RAFFLE AND AUCTION OF SOVEREIGN.

Raffle	£13	10	0
Hirst, H.	20	0	0
Hunter, C. E.	15	0	0
Hawes, F. B. O.	6	0	0
Taylor, G. E.	5	0	0
	£59	10	0

In the list of subscribers to the Benevolent Institution published in our last issue, for "MacDonall, Syer & Co." read "Macdonald, Syer & Co., Ltd."

The Metric System in the United States. — Out of 58,226 petitions relating to the exclusive use of metric weights and measures in U.S.A., now in the keeping of the Bureau of Standards, Department of Commerce, 99.27 per cent. favour this progress, and only 426, or less than 1 per cent., oppose it. Some of these petitions represent unanimous resolutions passed at conventions of organisations with thousands of members. Manufacturing and engineering concerns, engineers, architects, and contractors were 9,968 in favour, and only 154 against. Chambers of commerce, trade organisations, exporters, and importers were 9,974 in favour, and only 51 against. Educational institutions, beneficient organisations, and individuals in professions were 22,443 in favour, and only 74 against. In all other vocations over 99 per cent. favoured metric standards exclusively.

NEW PATENTS APPLIED FOR, 1919.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

28,439. "Projection lamps." H. MALER. November 17th.
28,448. "Control of asynchronous electric motors." SIEMENS-SCHUCKERTWERKE. November 17th. (Germany, August 31st, 1918.)
28,449. "Manufacture of electric thermo-elements." C. B. BURDON. (Siemens & Halske Akt. Ges.) November 17th.
28,461. "Electric couplings." W. E. BARBER and E. HOYLE. November 17th.
28,478. "Electrical seam-welding machines." E. SCHRODER. November 17th. (Germany, June 12th, 1918.)
28,491. "Aerial systems." W. J. PICKEN and J. G. ROBB. November 17th.
28,499. "Electric gas lamps with glow discharge." AKT. GES. J. PINTSCH. November 17th. (Germany, October 27th, 1917.)
28,500. "Electric gas lamps with glow discharge." AKT. GES. J. PINTSCH. November 17th. (Germany, November 6th, 1917.)
28,501. "Electric gas lamps with glow discharge." AKT. GES. J. PINTSCH. November 17th. (Germany, December 12th, 1917.)
28,507. "Rotary electric machines." K. NOBUHARA. November 17th.
28,518. "Phonic motor drive for telegraph machines." D. MURRAY. November 18th.
28,529. "Trolley heads for overhead electric tramcars, &c." L. SUNDERLAND. November 18th.
28,534. "Sparking plugs." J. P. REIJNHOUT. November 18th.
28,543. "Field magnet for dynamo-electric generators and motors." F. A. PLUMB. November 18th.
28,567. "Electrical fuses." CABLE ACCESSORIES CO., A. CRAWFORD and F. H. REEVES. November 18th.
28,595. "Sparking plugs." H. F. F. MINOT. November 18th. (France, February 12th.)
28,596. "Cooling electric dynamo machines and transformers and recovering waste heat therefrom." SOC. DE MOTEURS A GAZ ET D'INDUSTRIE MECANIQUE. November 18th. (France, October 14th, 1918.)
28,599. "Electrical transformers." BRITISH THOMSON-HOUSTON CO. (General Electric Co.) November 18th.
28,600. "X-ray apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co.) November 18th.
28,628. "Safety controlling-gear for electrically-propelled vehicles." F. GARRETT and R. GARRETT & SONS. November 19th.
28,648. "Electric switch for alarm, &c., clocks." V. A. WRIGHT. November 19th.
28,649. "Electric baling-presses." J. H. HINDLE and T. HINDLE. November 19th.
28,650. "Method of sound reproduction for gramophones, telephones, &c." F. GAILLARD. November 19th.
28,653. "Carrying and covering wires in electric installations." H. ARMSTRONG. November 19th.
28,658. "Alternating-current dynamos for lighting." A. E. GLANVILL. November 19th.
28,671. "Adjustable housing for centralising timing lever and fitments with armature and contact breaker of magneto." W. H. SHILLING. November 19th.
28,678. "Electric switches." W. E. BARBER. November 19th.
28,695. "Method of controlling electrically-heated apparatus." H. JAGGI-ZUMBUHL. November 19th. (Switzerland, June 21st.)
28,706. "Electricity meters." W. LAWSON. November 19th.
28,712. "Lamps and reflectors' holders for flashlights." H. M. KORETZKY. November 19th.
28,718. "Automatically-controlling electric lights in railway coaches." E. H. BARKWAY. November 19th.
28,721. "Miners' safety lamps." G. OLDHAM, J. OLDHAM, O. OLDHAM, and OLDHAM & SON. November 19th.
28,725. "Hollow-base electric winches." A. CUNNINGHAM. November 19th.
28,730. "Electric conductors." P. DUNSHEATH, W. T. HENLEY'S TELEGRAPH CO., and A. W. C. MCARTHUR. November 19th.
28,742. "Electrical resistance heater for high temperatures." SOC. ANON. DES ATELIERS DE SECHERON. November 19th. (Switzerland, December 6th, 1918.)
28,743/4. "Electrical resistance heater for high temperatures." SOC. ANON. DES ATELIERS DE SECHERON. November 19th. (Switzerland, February 12th.)
28,762. "Electric dry cells." BURGESS BATTERY CO. November 19th. (United States, November 19th, 1918.)
28,765. "Electric torches for walking sticks and umbrellas, &c." J. LEECHMAN. November 19th.
28,766. "Fuse adapter for portable electric lamps, &c." E. CHRISP. November 19th.
28,768. "Wireless telephonic and telegraphic apparatus and systems." W. J. RICKETS. November 20th.
28,772. "Primary electric batteries." B. F. S. BADEN-POWELL. November 20th.
28,785. "Apparatus for making and breaking electrical circuits." S. STENBERG and C. E. TAYLOR. November 20th.
28,796. "Contacts for electrical switches, fuses, plug connectors, &c." H. F. SHANAHAN. November 20th.
28,797. "Devices for preventing removal of incandescent electric lamps from their holders." J. FIRTH and S. STAPLETON. November 20th.
28,800. "Sound transmitting instruments." A. MARK. November 20th.
28,807. "Telephonic transmitters and receivers." R. S. CLAY and E. H. ECCLES. November 20th.
28,812. "Telephone ringing contacts." O. T. G. COOPER. November 20th.
28,820. "Electro-generator sets." E. G. BRUNOT and E. H. F. CHATEAU. November 20th.
28,843. "Duplex cable signalling." L. COHEN. November 20th. United States, May 27th.)
28,844. "Wireless transmission of energy." E. C. HANSEN. November 20th. (United States, September 7th, 1915.)
28,845. "Electrolytic apparatus." E. A. ASHCROFT. November 20th.
28,854. "Bayonet-joint sockets of electric-lamp bulb-holders, &c." A. H. MACKLEY. November 20th.
28,856. "Protective devices for alternating current distribution systems." BRITISH THOMSON-HOUSTON CO. and H. K. TRECHMAN. November 20th.
28,864. "Electrical conductors." F. W. BERWICK & CO. and M. H. L. SIZAIRE. November 20th.
28,872. "Electricity meters." CHAMBERLAIN & HOOKHAM and S. JAMES. November 20th.
28,873. "Interrupting devices for electric circuits." CHAMBERLAIN & HOOKHAM and S. JAMES. November 20th.
28,877. "Sparking plugs." G. L. DELFOSSE. November 20th.
28,880. "Wireless signalling system." J. H. ROGERS. November 20th. (United States, January 10th.)
28,882. "Electrical switchboard apparatus." WAYGOOD-OTIS, LTD. (Otis Elevator Co.) November 20th.
28,889. "Arc lamps." SPERRY GYROSCOPE CO. November 20th. (United States, November 20th, 1918.)
28,893. "Controllers for electric motors." C. E. FAIRBURN. November 20th.
28,935. "Leads for arc lamps." W. KITCHINGMAN. November 21st.
28,940. "Electric warmers." C. C. SMITH. November 21st.
28,944. "Telegraph printing systems." AUTOMATIC TELEPHONE MANUFACTURING CO., H. H. HARRISON and S. R. SMITH. November 21st.
28,948. "Sparking plug." G. J. MORGAN and R. M. MORGAN. November 21st.
28,949. "Combined electric incandescent or glow lamp holders and switches." R. T. NORTON. November 21st.
28,975. "Magneto-electric machines." BRITISH THOMSON-HOUSTON CO. H. W. H. WARREN and A. P. YOUNG. November 21st.
28,976. "Sparking plugs." A. E. LAMKIN. November 21st.
28,988/90. "Sparking plugs." T. F. NEWMAN. November 21st.
29,022. "Electric irons." A. W. KIMBER. November 21st.
29,029. "Water-tight electric light fittings." P. ETCHEPARE and I. KORNFELD. November 21st.
29,033. "Electric switches." BRITISH EVER READY CO. and H. F. WESTNEY. November 21st.
29,078. "Device for disinfecting telephone instruments." R. COOPER. November 21st.
29,082. "Sparking plugs." A. W. ARMSTRONG. November 22nd.
29,084. "Thermionic devices." J. SCOTT-TAGGART. November 22nd.
29,094. "Storage batteries." U.S. LIGHT AND HEAT CORPORATION. November 22nd. (United States, September 8th, 1917.)
29,098. "Current detectors in connection with electric ignition of internal-combustion engines." E. V. HAVES-GRATZE. November 22nd.
29,124. "Electric switches." R. B. COOMBS and C. E. JENKS. November 22nd.
29,140. "Moulds for manufacture of glass insulated sparking-plugs." C. E. GERRALD. November 22nd.
29,141. "Thermionic devices." H. M. DOWSETT. November 22nd.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

10,717. RECEIVERS FOR WIRELESS TELEGRAPHY. Marconi's Wireless Telegraph Co. and C. S. Franklin. June 28th, 1918. (134,246.)
10,839. TELEPHONES. Akt. Ges. Siemens & Halske. July 14th, 1917. (134,247.)
11,013. AUTOMATIC REGULATOR FOR DYNAMO-ELECTRIC MACHINES. O. Imray, (Akt. Ges. R. Bosch.) July 4th, 1918. (134,248.)
12,189. COMBINATION ELECTRIC HEATER. J. H. Robinson and W. O. Workman. July 26th, 1918. (134,249.)
15,530. LAMPS FOR LIGHTING. H. R. Evans. September 21st, 1917. (119,470.)
16,054. ELECTRIC SWITCHES. J. B. Tucker and J. A. Crabtree. October 3rd, 1918. (134,266.)
17,468. SIGNALLING LAMPS, AIRCRAFT RECOGNITION LAMPS, MOTOR VEHICLE HEADLIGHTS, AND THE LIKE. A. C. W. Aldis. October 25th, 1918. (134,281.)
17,567. ELECTRIC FUSIBLE CUT-OUTS. H. E. Trent. October 28th, 1918. (134,290.)
17,575. SWITCH CONTROL FOR AUTOMOBILE ELECTRIC TAIL LIGHTS. D. G. Zatocostas. October 28th, 1918. (134,291.)
17,631. OSCILLATORY MERCURY MAKE AND BREAK APPARATUS FOR WIRELESS TELEGRAPHY OR THE LIKE PURPOSES. Comparri Wireless Control Syndicate and M. Compare. October 29th, 1918. (134,297.)
17,754. MANUFACTURE OF ELECTRIC DRY BATTERIES. Burgess Battery Co. October 30th, 1917. (120,891.)
17,935. DETECTOR OF VARYING MAGNETIC FIELDS WITH APPLICATION TO VIBRATION GALVANOMETERS OR OSCILLOGRAPHS. F. O. Hunt. November 4th, 1918. (Cognate application No. 10,943/19.) (134,338.)
18,073. ELECTRO-MAGNETIC WAVE TRANSMITTING AND RECEIVING SYSTEMS. R. Whiddington and P. P. Eckersley. November 4th, 1918. (134,341.)
18,075. WIRELESS DIRECTION-FINDING ARRANGEMENTS. J. Robinson. November 4th, 1918. (134,342.)
18,395. TELEPHONE RECEIVERS. S. G. Brown. November 9th, 1918. (134,353.)
18,431. WARD LEONARD SYSTEM OF ELECTRIC DRIVING. S. G. Jones. November 11th, 1918. (134,354.)
18,650. HOLDERS FOR INCANDESCENT LAMPS. F. Quarmby. November 14th, 1918. (Addition to 18,476/17.) (134,364.)
18,722. ELECTRICAL SOUND-DETECTING DEVICES. Automatic Telephone Manufacturing Co. and J. B. Redfern. November 15th, 1918. (134,365.)
18,951. ELECTRIC SWITCHES OR CIRCUIT INTERRUPTERS. W. A. Coates, W. B. Dale and British Westinghouse Electric and Manufacturing Co. November 19th, 1918. (134,376.)
19,630. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. C. K. Shepherd. November 28th, 1918. (134,388.)
19,818. METHOD OF ELECTRICALLY WELDING IRON, STEEL, BRASS AND OTHER METALLIC STUDS AND THE LIKE TO IRON, STEEL OR OTHER PLATING AND THE LIKE. A. E. Frankling. November 30th, 1918. (134,393.)
20,380. MEANS FOR THE DISINFECTION OF TELEPHONE INSTRUMENTS. E. A. B. Snoaden. December 7th, 1918. (134,404.)
21,166. HEADLIGHT FOR MOTOR-CARS AND OTHER APPLICATIONS. P. Heidelberg. December 18th, 1918. (134,414.)
21,541. ELECTRIC FURNACES. D. F. Campbell. December 23rd, 1918. (134,422.)

1919.

816. MEANS FOR GRIPPING SUBMARINE CABLES OR THE LIKE. Telegraph Construction and Maintenance Co. and L. Gibson. January 11th, 1919. (134,434.)
1,562. REPEATING OR AMPLIFYING SYSTEMS, PARTICULARLY APPLICABLE FOR TELEPHONY. Western Electric Co. (Western Electric Co.) January 21st, 1919. (134,444.)
2,236. IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. Splitdorf Electric Co. June 8th, 1918. (128,189.)
5,270. RAILWAY TRAFFIC CONTROLLING SYSTEMS. McKenzie, Holland & Westinghouse Power Signal Co. March 4th, 1918. (124,201.)
5,883. ELECTRIC IGNITER. W. W. Partington. March 10th, 1919. (134,469.)
5,931. ELECTRIC FURNACE FOR HEATING, ANNEALING, OR MELTING METALLIC MATERIALS. A. Pouchain Stabilimenti Biak-Ing. March 9th, 1918. (124,438.)
7,333. ELECTRICALLY-HEATED SOLDERING BITS. P. Marchiaro. March 24th, 1919. (134,472.)
8,164. MINERS' ELECTRIC LAMPS. E. H. Taylor and S. F. Tyler. April 1st, 1919. (134,476.)
13,122. WIRELESS TELEGRAPHY STATIONS WORKING ON THE DUPLEX SYSTEM. H. J. J. M. de Regnauld de Bellescize. January 22nd, 1919. (134,497.)
13,523. RADIO-SIGNALLING APPARATUS. Marconi Wireless Telegraph Co. July 12th, 1918. (129,625.)
16,570. ELECTRIC COUPLING OR CONNECTING DEVICES. H. E. Angold. July 2nd, 1919. (134,505.)
18,320. ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. September 19th, 1917. (130,333.)